To advance the economic, social and environmental sustainability of Northern California
by enhancing and preserving the water rights, supplies and water quality.

February 2, 2012

VIA ELECTRONIC MAIL: eircomments@deltacouncil.ca.gov

Mr. Phil Isenberg
Chair, Delta Stewardship Council
980 Ninth Street, Suite 1500
Sacramento, California 95814

Re: Draft Delta Plan EIR

Dear Chairman Isenberg and Members of the Council:

The Northern California Water Association (NCWA) is an association of water suppliers and local governments throughout the Sacramento Valley, whose water supplies over 2,000,000 acres of farms, much of the habitat for birds using the Pacific Flyway, the cities and rural communities, recreational opportunities and the fisheries throughout the region. NCWA is committed to advance the economic, social, and environmental sustainability of the Sacramento Valley by enhancing and preserving its water rights, supplies, and water quality for the rich mosaic of farmlands, cities and rural communities, refuges and managed wetlands, and meandering rivers that support fisheries and wildlife.

NCWA and others in the Sacramento Valley have provided comments to nearly every draft version of the Delta Plan and we have reviewed the Draft Delta Plan Program Environmental Impact Report (the "Draft EIR") and provide the following comments.

1. Summary of NCWA Comments

The DEIR confirms that the draft Delta Plan's primary ecosystem tool would be an attempt to accelerate the implementation of a "more natural flow regime." NCWA's comments to the Fifth Draft of the Delta Plan focused on concerns with the natural flow regime and we provided comments on the DEIR as part of a north state coalition letter on January 20, 2012. Similarly, these comments to the DEIR also focus in a more detailed manner on the significant effects a natural flow regime would have on the Sacramento Valley.

Unfortunately, neither the draft Delta Plan nor the DEIR explain in any way what this means practically. This failure makes the DEIR's project description illegally vague. The DEIR then compounds this failure by failing to analyze, in any significant way, the impacts that implementing a "more natural flow regime" would have on the Sacramento Valley's fisheries, migratory birds and water supplies, not to mention the hydropower supplies that benefit the entire state. The December 2011 technical report prepared for the Water and Power Policy Group, which is attached to this letter for your reference, demonstrates that the implementation of a "more natural flow regime" would devastate water-supplies, public trust resources, and hydropower generation, thereby preventing achievement of the "co-equal goals." The DEIR attempts to assume away the water-supply impacts that implementing a "more natural flow regime" would cause by claiming that water districts would implement new water supplies, not to mention the hydropower supplies that benefit the entire state. Moreover, the DEIR fails to acknowledge that implementation of a "more natural flow regime" could cause the Bureau of Reclamation to be unable to satisfy its contractual obligations, which could destabilize all Central Valley Project (CVP) deliveries and lead to serious environmental impacts in CVP export regions.

Finally, the DEIR fails to analyze how the draft Delta Plan's terms themselves – mainly, policy ER P1 and recommendation WR R5 – could prevent NCWA's members from implementing new water projects to address the impacts that implementing a "more natural flow regime" would cause. NCWA urges the Delta Stewardship Council to revise the draft Delta Plan's policies and recommendations that would impair the Sacramento Valley's regional self-sufficiency as described in Water Code section 85021.

2. <u>Comments on Draft EIR</u>

NCWA has the following comments on the DEIR:

A. <u>The DEIR Confirms That the Proposed Acceleration Of A "More Natural Flow Regime" Is Central To The Proposed Project, But Violates CEQA By Failing To Define That Key Project Element</u>

Section 2.2.4.1 of the DEIR states that the proposed project includes, in proposed policy ER P1, encouragement to the State Water Resources Control Board (SWRCB) to complete "flow objectives and flow criteria by 2014 and 2018 [for the Delta and high-priority tributaries in the Delta watershed], respectively . . . ." (DEIR, p. 2A-39.) The DEIR assumes that the SWRCB "will meet the recommended deadlines" and that proposed policy ER P1 "could encourage a more natural flow regime in the Delta." (DEIR, p. 2A-39.) The DEIR then states: (1) in numerous places, that the proposed project will accelerate the implementation of a "more natural flow regime;" (2) this fact distinguishes the proposed project from various project alternatives; and (3) "the No Project Alternative assumes that ongoing studies by the SWRCB to evaluate future Delta flow objectives . . . would continue on their current courses." (DEIR, pp. 2A-68:7-8; 2A-68:25-26, 2A-73; 2A-87:35-36; 2A-93:27-31; 2A-95:35-36; 2B-6; 2B-11; 2B-15; 2B-16; 3-86:39 to 3-87:3; 3-94:27-30; 4-87:10-14; 4-87:23-24; 4-88:1-3; 4-88:21-25; 4-88:42 to 4-89:4; 4-89:40-41; 4-90:16-21; 4-91:6-8; 4-91:34-37; 4-94:36-38; 6-50:11-13; 6-64:39-41; 6-66:17.) In particular, the DEIR states the following in identifying the proposed project as the environmental superior alternative:

> <u>The biggest differentiators among the Proposed Project and alternatives, given their varying focus and the subject matter requirements of the Delta Reform Act, related to the long-term impacts to biological resources</u>, flood risk reduction, water supply and water quality, and agricultural land . . .

> Alternatives 1A and 1B are inferior mostly because they would fail to arrest the increasing environmental deterioration of the Delta ecosystem. They fail to do so because they would result in fewer ecosystem restoration projects in the Delta and would be less aggressive in moving toward minimum standards for water flow in the Delta necessary for a healthy fishery and ecosystem.

(DEIR, pp. 25-10:36-38, 25-11:8-11 (emphasis added).)

The DEIR accordingly portrays acceleration toward implementation of a "more natural flow regime" as a fundamental part of the proposed project. The draft Delta Plan contains no definition of a "more natural flow regime." (Fifth draft Delta Plan, pp. 112-114.) The DEIR also fails to define a "more natural flow regime." An enormous variety of streamflow schedules could be viewed as a "more natural flow regime." For example, implementation of a "more natural flow regime" could be limited to measures to reduce the extent to which Sacramento River water is drawn to the south Delta by CVP and State Water Project operations. Reducing these reverse flows is one of the goals of the Bay-Delta Conservation Plan. Alternatively, implementing a "more natural flow regime" could involve a complete restructuring of all water project operations in the Delta watershed as would be required if the streamflow criteria stated in the SWRCB's August 3, 2010 Delta flow criteria report were implemented. As the Council is aware, the Delta Reform Act stated that those criteria would inform the Delta Plan (Water Code §85086(c)(1)), and those criteria included the following:

- Net Delta outflows set at 75% of average unimpaired flow from January through June;
- Sacramento River flows at Rio Vista set at 75% of average unimpaired flow from April through June; and
- San Joaquin River flows at Vernalis set at 60% of average unimpaired flow from February through June.

(SWRCB, Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem, pp. 131-133 (Aug. 3, 2010).)

Given this extreme variability in what might be considered a "more natural flow regime," the failure of the draft Delta Plan and the DEIR to define what they mean in proposing to accelerate the implementation of such a regime causes the DEIR to violate CEQA. The courts have long declared that "[a]n accurate, stable and finite project description is the *sine qua non* of an informative and legally sufficient EIR." (*Save Round Valley Alliance v. County of Inyo* (2007) 157 Cal.App.4th 1437, 1448 (quoting *County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 199).)

B. The DEIR Fails To Analyze the Many Impacts That Implementing A "More Natural Flow Regime" Could Cause

Implementing a "more natural flow regime" could have severe impacts on the water supplies for many beneficial uses in the Sacramento Valley. Preliminarily, notwithstanding NCWA's pre-DEIR submission of detailed information about existing state-of-the-art streamflow requirements in the Sacramento Valley, as described in NCWA's September 30, 2011 letter to the Council, the DEIR fails to include those requirements in describing the proposed project's environmental setting. Hydrological modeling of the kind necessary for the Council to at least generally analyze the impacts that implementing a "more natural flow regime" would cause has been available since at least early 2010, but the DEIR fails to consider it.

Most strikingly, the available information shows that implementing such a flow regime, despite its stated intent to benefit fisheries, could have very significant impacts on the Sacramento Valley's fisheries, including its populations of Chinook salmon and steelhead. In fact, as discussed in an April 2011 report by Dave Vogel – a fisheries biologist with decades of experience working in the Sacramento Valley – attempting to implement such a flow regime could undermine 20 years of work in the Valley to improve conditions for salmon. (Mr. Vogel's report is discussed in more detail below.) The available information also shows that implementing a "more natural flow regime" could significantly impair water diversions. These reduced diversions in turn would have significant negative impacts on the following resources:

- Birds using the Pacific Flyway;
- The Sacramento Valley's farmlands and the terrestrial species that use them as habitat;
- The Sacramento Valley's wildlife refuges;
- The Sacramento Valley's groundwater resources;
- Hydroelectric generation associated with the Sacramento Valley's reservoirs, resulting in increased greenhouse gas emissions.
- Recreation, including the major reservoirs in the region; and
- Groundwater resources as a result of additional pumping to make up for lost surface water supplies.

i. Implementing A "More Natural Flow Regime" Could Have Severe **Hydrological Impacts**

While it is not possible to determine the impacts of the "more natural flow regime" that the draft Delta Plan proposes given that proposal's vagueness, information available to the Council prior to the DEIR's preparation shows how severe the resulting hydrological impacts could be. During the SWRCB's 2010 Delta flow criteria proceeding, the Sacramento Valley Water User (SVWU) group presented testimony concerning hydrological modeling of flow criteria proposed by third parties. That hydrological testimony concerned, among other proposals, flow regimes proposed by members of UC Davis's Center for Watershed Sciences to provide enhanced ecosystem services in the Delta watershed, including significantly increased Sacramento River flows to benefit salmon and significantly increased Delta outflows to benefit delta smelt (exhibit SVWU-60).[1] The SVWU hydrological testimony (exhibit SVWU-1) demonstrates that such a flow regime would:

[1]All of the testimony and exhibits presented to the SWRCB by the SVWU group and NCWA, including the referenced UC Davis report, are available on the SWRCB's website at http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/svwu.shtml and have been available there since 2010.

- Significantly reduce storage in Shasta, Oroville and Folsom Reservoirs, with storage levels being drawn below levels specified for water temperature control in the National Marine Fisheries Service's (NMFS) last Central Valley salmon biological opinion and even to dead pool in many years; and

- Significantly increase streamflows in the March-May period and significantly decrease streamflows during the rest of the year, resulting in probable violations of water temperature standards set to protect listed fish species.

SVWU also modeled the impacts of the criteria that the SWRCB eventually adopted as part of its 2010 Delta flow criteria report. The State and Federal Contractors Water Agency submitted a summary of the results of the SVWU's modeling with an October 1, 2010 letter to both the Council and the SWRCB.[2] That modeling showed that the SWRCB's Delta flow criteria, if implemented, would have impacts similar to the proposals presented by the UC Davis, including:

- Much more frequent reductions of storage in upstream reservoirs below levels specified for water temperature control in NMFS's most recent Central Valley salmonid biological opinion, with Shasta Reservoir reaching dead pool by the end of April in some years; and

- Significant shifts of releases to the Sacramento River from the June-September period to the February-May period, resulting in probable violations of water temperature standards set to protect listed fish species.

While the proposed flows analyzed in the SVWU group's work may not completely conform to a given "more natural flow regime" whose implementation might be accelerated by the Delta Plan, that work demonstrates just how significant the hydrologic effects of major alterations to the flow regime in the Delta and its watershed could be. As discussed below, these effects could result in significant impacts to many resources in the Sacramento Valley. The DEIR, however, fails to consider – in even the most general terms – any of the available hydrologic modeling that estimates such impacts. This failure alone demonstrates that the DEIR does not adequately analyze the draft Delta Plan's hydrological impacts. Moreover, as discussed below, this failure causes the DEIR to inadequately analyze the draft Delta Plan's impacts on many other resources in the Sacramento Valley.

ii. <u>The DEIR Fails To Adequately Analyze The **Water-Supply Impacts** In The Sacramento Valley Of Accelerating The Implementation Of A "More Natural Flow Regime"</u>

As discussed above, implementation of a "more natural flow regime" as proposed by the draft Delta Plan and the DEIR would reduce storage in the Sacramento Valley's reservoirs dramatically. This reduction in storage would trigger very significant water-supply impacts because stored water is necessary to serve communities and irrigate crops during California's annual dry season. The SVWU's modeling of the impacts of implementing the SWRCB's 2010 Delta flow criteria confirms this conclusion. If the CVP's reservoirs were drained to dead pool by the end of April in critically dry years

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[2]NCWA has been unable to locate this October 1, 2010 letter and its exhibits on the Council's Website. Those materials, however, are on-line at http://cdm15025.contentdm.oclc.org/cgi-bin/showfile.exe?CISOROOT=/p267501ccp2&CISOPTR=3878&filename=3879.pdf.

– as the SVWU's modeling of the SWRCB's 2010 criteria indicates that they would be (Figures 2 and 8) – then there probably would be no water to deliver for any purpose from those reservoirs for at least six months until the following rainy season. In California, however, dry years often arrive consecutively, indicating the very real possibility that implementing a "more natural flow regime" could result in there being consecutive years during a multi-year drought when California's water system would be unable to deliver water for communities and irrigation.

Concerning the water-supply impacts of the proposed project's proposal that the implementation of "more natural flow regime" be accelerated, however, the DEIR states:

> Under the Proposed Project, the SWRCB would be encouraged to modify Delta flow objectives in order to place more emphasis on creating a natural flow regime in the Delta. Such objectives would likely reduce the amount of water available for municipal, agricultural, and industrial water uses within the Delta and outside the Delta . . .
>
> Because the SWRCB would consider all beneficial uses during the development of Delta flow objectives, it is anticipated that Delta water would continue to be available for municipal, agricultural, and industrial water uses, but at a reduced amount.

(DEIR, pp. 3-84 to 3-85.)

The DEIR then declares that these impacts would be less than significant because the proposed project would trigger the implementation of additional local and regional projects that would compensate for the "reduced amount" of available "Delta water." (DEIR, pp. 3-84 to 3-85.) This declaration simply is not adequate to satisfy CEQA's requirement that an EIR analyze the proposed project's environmental impacts.

The DEIR's water-supply discussion is impermissibly vague concerning the proposed project's water-supply impacts upstream of the Delta. The DEIR fails to define what the above discussion means by "Delta water," so it is impossible to determine whether the DEIR contains any analysis of the impacts that implementing a "more natural flow regime" would have on Sacramento Valley water supplies.

If the DEIR's statement that implementing such a flow regime would reduce the amount of "Delta water" available for consumptive use applies to water users in the Sacramento Valley, then the DEIR's discussion of that subject is still inadequate. The DEIR states that the proposed project would result in less-than-significant water-supply impacts because water users would augment their water supplies by implementing more local and regional water projects. (DEIR, p. 3-85.) In the Sacramento Valley, however, local and regional water projects generally must involve the use of water sources that are tributary to the Delta. Additional local and regional water projects in the Sacramento Valley generally would increase the use of water from the Delta's tributaries, although much of that water would be reused within the watershed, just as existing operations in the Sacramento Valley reuse water many times. The detailed operations and management of the Sacramento Valley is described in the July 2011 report "Efficient Water Management for Regional Sustainability in the Sacramento Valley," which is available on NCWA's website.[3]

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[3] http://www.norcalwater.org/wp-content/uploads/2012/01/Technicalreport-jul2011.pdf

The DEIR simply fails to acknowledge these realities and account for differences in the water supplies available to the Sacramento Valley and those available to export areas. It would be impossible for the Sacramento Valley to significantly compensate for water-supply impacts caused by the implementation of a "more natural flow regime" when the available water sources essentially are all tributary to the Delta. The DEIR's discussion of the proposed project's water-supply impacts therefore fails to comply with CEQA.

iii. The DEIR Fails To Adequately Analyze the Sacramento Valley **Fishery** Impacts Of Accelerating The Implementation Of A "More Natural Flow Regime"

An EIR must adequately describe a project's environmental setting. (Cal. Code Regs., tit. 14, § 15125(a); *Cadiz Land Co. v. Rail Cycle* (2000) 83 Cal.App.4th 74, 91-94 (EIR must adequately describe groundwater aquifer that would be affected by proposed project).) NCWA submitted a description of the existing streamflow requirements for the Sacramento Valley's major rivers with a September 30, 2011 letter.[4] Nonetheless, while the November 4, 2011 DEIR's biological resources chapter describes the rivers in the Sacramento River watershed, it fails to describe in any way the existing streamflow requirements in the watershed's major rivers. (DEIR, pp. 4-39 to 4-45.) The DEIR fails to describe those existing requirements even though the Governor's Economic and Environmental Leadership Award has been awarded for two of the agreements that reflect those requirements, specifically the Yuba River Accord and the American River's Water Forum Agreement. The DEIR fails to do so even though: (A) it cites the final Yuba River Accord EIR as a source and in fact summarizes the Accord's Lower Yuba River Fisheries Agreement (DEIR Appendix H, p. H-2); and (B) NMFS's 2009 biological opinion for CVP and SWP operations incorporates the Water Forum's flow management standard. The DEIR's failure to describe existing streamflow conditions in the Sacramento Valley's rivers is, in itself, a violation of CEQA.

The Sacramento Valley streamflow requirements described in NCWA's September 30, 2011 submission have been developed in the last 10 years based on state-of-the-art science, largely to improve conditions in the Delta's tributaries for salmon and steelhead. It is impossible to determine from the draft Delta Plan and the DEIR how their proposed accelerated implementation of a "more natural flow regime" would impact continued implementation of existing streamflow requirements in the Sacramento Valley's rivers and the salmon and steelhead that those requirements benefit.

As a result of hard work in the Sacramento Valley over the last 20 years to improve stream conditions for salmon and steelhead, science indicates that the steps most needed to improve the Valley's salmonid fisheries actually must be taken in the Delta. In an April 2011 report to NCWA, Dave Vogel of Natural Resource Scientists, Inc., concluded, based on his review of the relevant literature and his decades of experience with salmonids in the Sacramento Valley that:

> In most respects, and relative to other parts of the state, habitat conditions for anadromous fish in the Sacramento River and its tributaries have improved significantly over the past two decades . . . While some opportunities remain in the Sacramento Valley . . . the available evidence indicates that conditions have become worse, not better, in the Delta during the most-recent decades. Despite the enormous, unprecedented actions to

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[4]NCWA's September 30, 2011 submission is located on-line on the Council's Website at http://www.deltacouncil.ca.gov/sites/default/files/documents/files/NCWA_093011.pdf.

> improve fish production in the upper watersheds, there has been remarkable lack of focus or progress to fix the serious predation and habitat problems in the Delta, through which all Sacramento Valley anadromous fish must migrate . . . **Until significant progress is made on correcting the habitat problems and largely site-specific sources of native juvenile anadromous fish mortality in the Delta, it is likely that many of the benefits of upstream actions are, and will continue to be negated.**

(Vogel, *Insights into the Problems, Progress, and Potential Solutions for Sacramento River Basin Native Anadromous Fish Restoration*, April 2011, pp. ii-iii ("Vogel 2011")(emphasis in original).)

In light of the progress that has been made in the Sacramento Valley, Mr. Vogel also advised that careful hydrological analysis would be necessary to ensure that the Valley's anadromous fish would not be harmed by new proposed streamflow requirements. (Vogel 2011, p. iii.) A copy of Mr. Vogel's April 2011 report is available on NCWA's website.

Rather than analyzing how the proposed project's acceleration of a "more natural flow regime's" implementation would impact existing state-of-the-art streamflow requirements in the Sacramento Valley and the anadromous fish those requirements were developed to support, the DEIR simply assumes that the SWRCB's accelerated implementation of a "more natural flow regime" would have beneficial or less than significant impacts on those fisheries. (DEIR, pp. 4-68:8-12; 4-69:10-14, 4-70:20-25.) This is a mere assumption and is not environmental analysis sufficient to comply with CEQA. The DEIR cannot declare that accelerated implementation of a "more natural flow regime" is a key component of the Delta Plan and then assume away the impacts that such implementation could have in the context of existing state-of-the-art streamflow requirements developed to benefit fisheries.

As the SVWU group's hydrological information described above indicates, significant revisions to the Sacramento Valley's existing flow regime – which is based on the streamflow requirements described in NCWA's September 30, 2011 submission – could prevent reservoirs and rivers from meeting regulatory standards designed to support listed fish species. Negative impacts to sensitive fish species probably would result. The DEIR's failure to analyze these probable fishery impacts causes the DEIR to violate CEQA.

iv. <u>The DEIR Fails to Adequately Analyze the Impacts Of Accelerating The Implementation Of A "More Natural Flow Regime" On Birds That Use **The Pacific Flyway**</u>

Many avian species use the Sacramento Valley's irrigated croplands as winter and breeding habitat. These croplands, especially small grains, provide crucial habitat in the Pacific Flyway, especially in areas such as the Central Valley where only a fraction of historic wetlands remain. The habitat values created by these croplands are described in detail in the Central Valley Joint Venture 2006 Implementation Plan (www.centralvalleyjointventure.org/science). The DEIR does not analyze the impact implementing a "more natural flow regime" could have on the Sacramento Valley's water supplies, including a reduction in the diversions that support habitat values on both irrigated cropland and natural wetlands which rely on agricultural tailwater. The DEIR therefore does not comply with CEQA.

v. <u>The DEIR Fails To Adequately Analyze The Impacts Of Accelerating The</u>

Implementation Of A "More Natural Flow Regime" On The Sacramento Valley's **Farmlands** and the **Terrestrial Species** That Depend On Those Valley Farmlands

The DEIR recognizes that the conversion of important farmlands to non-agricultural use can be a significant environmental impact. (DEIR, p. 7-18.) The DEIR, however, fails to analyze the impacts on the Sacramento Valley's farmlands of the draft Delta Plan's proposal to implement a "more natural flow regime." As discussed above, implementing such a flow regime would have severe hydrological impacts. The amount of water available for agricultural use in the Sacramento Valley would be significantly reduced, which would deny the Valley's farmers of the reliable surface-water supplies on which they have relied for decades. A likely consequence of this radical shift would be a significant conversion of existing agricultural lands to non-agricultural use. By the DEIR's own estimation, this impact of the Council's proposed project would be significant and yet the DEIR does not analyze it.

The loss of agricultural lands in the Sacramento Valley caused by the Council's proposed project would have additional and significant environmental impacts. Terrestrial species such as the giant garter snake use the Valley's irrigated croplands as habitat. The DEIR asserts that fallowing north-of-Delta cropland to support water transfers could impact giant garter snake. (DEIR, pp. 4-64 to 4-65.) The DEIR, however, fails to analyze the much more significant impacts that implementing a "more natural flow regime" would have on that species, and other sensitive terrestrial species, as a result of the significant water-supply impacts that implementing such a flow regime would have. The DEIR's failure to analyze these significant impacts on sensitive terrestrial species that depend on the Sacramento Valley's irrigated croplands causes the DEIR to violate CEQA.

vi. The DEIR Fails To Adequately Analyze the Impacts Of Accelerating The Implementation Of A "More Natural Flow Regime" On The Sacramento Valley's **Groundwater**

Nearly all of the Sacramento Valley has always had reliable surface-water supplies and its communities and farms therefore have always been self-sustaining. The Valley's groundwater supplies reflect its sustainability. As the fifth draft Delta Plan itself recognizes (p. 91), the Valley's groundwater aquifers have been stable for decades. If, however, a "more natural flow regime" were implemented as proposed by the draft Delta Plan and DEIR, then Valley's communities and farms would be forced to pump significantly more groundwater in order to attempt to maintain the region's economy. Groundwater levels would decline. This is not guess. Groundwater levels in southern Yuba County were significantly overdrafted before Yuba County Water Agency (YCWA) began delivering water there in the mid-1980s, but have recovered to historic levels since. (DWR, Bulletin 160-09, *Cal. Water Plan, 2009 Update*, vol. 2, p. 8-20.) If surface-water supplies throughout the Sacramento Valley were significantly reduced because a "more natural flow regime" was implemented, there likely would be groundwater declines throughout the Valley similar to those that occurred in southern Yuba County before YCWA's deliveries began.

The DEIR recognizes that substantial depletion of groundwater can be a significant environmental impact. (DEIR, p. 3-76.) The DEIR, however, does not analyze the impacts on groundwater supplies of the Council's proposed implementation of a "more natural flow regime." (See DEIR, p. 3-84.) The DEIR therefore does not adequately analyze the impacts of implementing the Council's proposed project.

vii. The DEIR Fails To Adequately Analyze the Impacts Of Accelerating The Implementation Of A "More Natural Flow Regime" On Sacramento Valley **Wildlife Refuges**

As stated in the *Final NEPA Environmental Assessment and CEQA Initial Study. Refuge Water Supply, Long-term Water Supply Agreements, Sacramento River Basin* referenced in Section 4.3.3.6.1 of the DEIR, for each of the Sacramento Valley Refuges, "managed wetlands are composed of seasonal wetlands (flooded from August or September to April), moist soil impoundments (flooded from August through May and irrigated once in June; sometimes referred to as "watergrass units"), summer water (flooded September through mid-July), and permanent wetlands (flooded year-round) (G. Mensik, 2000)." As discussed above, implementation of a "more natural flow regime" as proposed by the draft Delta Plan and DEIR would severely limit the physical availability of critical water supplies in the fall and winter months. These limitations on water supplies in the Sacramento Valley generally would reverberate specifically in limitations to water supplies for refuges during the most critical times for those resources. The DEIR does not adequately analyze these impacts of the Council's proposed implementation of a "more natural flow regime."

viii. The DEIR Fails To Adequately Analyze The Impacts Of Accelerating The Implementation Of A "More Natural Flow Regime" On **Hydroelectric Generation** In The Sacramento Valley And The Resulting Increased GHG Emissions

The DEIR recognizes that a project may have significant environmental impacts if it were to require the development of new electricity generating facilities or the expansion of existing facilities and those facilities could result in significant environmental impacts. (DEIR, pp. 20-6 to 20-7, 20-13.) The DEIR, however, fails to analyze in any way the adverse impacts on hydroelectric generation in the Sacramento Valley that implementing a "more natural flow regime" would have and the environmental impacts that replacement electrical sources would have.

In the Delta watershed, the natural flow regime involves high streamflows in the winter precipitation season and the spring snowmelt season. Given this natural hydrology, water storage is necessary to support hydroelectric generation during the high-demand summer months. Such water storage is not possible without modifying the natural flow regime by diverting high winter and spring streamflows into reservoirs.[5] The hydrologic modeling conducted by the SVWU group discussed above demonstrates that requirements that attempt to more closely replicate flow conditions result in reduced reservoir storage and shifts of streamflows from the summer and fall into the spring.

These hydrological shifts associated with implementing a "more natural flow regime" would be likely to both reduce hydroelectric generation and shift significant amounts of that generation from the warmer and high-electrical demand summer months to the more temperate and low-electrical-demand spring months, as suggested by the MBK reports submitted to the SWRCB as part of the Delta Flow Criteria proceedings and the Water and Power Policy Group described earlier. Reduced generation is likely to occur because a "more natural flow regime" will reduce the reservoir storage on which much generation depends. Generation shifts will occur because a "more natural flow regime" will demand that more

[5]In contrast to water storage for consumptive use – for which increased groundwater storage might mitigate some impacts to surface storage, if at potentially higher cost – groundwater storage cannot replace surface storage for hydroelectric generation because such generation depends on water falling under gravity's influence to turn turbines.

water be released through hydroelectric plants in the spring months when more natural runoff occurs. The reduced and shifted generation will require the development of replacement generation facilities. The DEIR stated that such an impact would be significant (DEIR, pp. 20-6 to 20-7), but fails to analyze whether this impact will occur as a result of the implementation of a "more natural flow regime," as proposed by the draft Delta Plan. The DEIR therefore violates CEQA because it fails to analyze an impact that, by the DEIR's own admission, could be significant.

The electrical generation that would not occur because of the implementation of a "more natural flow regime" probably would be replaced by generation that relies on fossil fuels. This increased use of fossil fuels would increase greenhouse gas emissions. The DEIR recognizes that hydroelectric generation can reduce GHG emissions where that generation replaces carbon-based generation. (DEIR, pp. 21-11 to 21-12.) Nowhere, however, does the DEIR recognize that the increased GHG emissions that would occur if implementation of a "more natural flow regime" were to compel the replacement of lost or shifted hydroelectric generation with new carbon-based generation. The DEIR's failure to analyze this impact of a key element of the proposed project violates CEQA.

C. The DEIR Fails To Analyze The Impacts On Sacramento Valley Water Users Of The Draft Delta Plan's Proposed Policy ER P1 And Proposed Recommendation WR R5

The DEIR bases its environmental analysis on what it terms a "very conservative approach" of assuming that "the Delta Plan has the desired outcome" through other agencies' actions. (DEIR, p. 2B-2.) The DEIR then organizes its analysis "to address the types of actions, activities, and projects of other agencies, which the Council seeks to influence through the Delta Plan's Policies and Recommendations," stating:

> The types of expected projects, both covered actions and non-covered actions, fall into five categories that closely track the Delta Plan's general topical organization:
>
> - Reliable water supply
> - Delta ecosystem restoration
> - Water quality improvement
> - Flood risk reduction
> - Protection and enhancement of Delta as an evolving place.

(DEIR, p. 2B-3.)

This analytical approach is fundamentally flawed and fails to comply with CEQA because it fails to analyze the environmental impacts of specific proposed Delta Plan policies and recommendations that would be implemented assuming that, as the DEIR puts it, "the Delta Plan has the desired outcome." For the Sacramento Valley, this crucial failing is demonstrated by the DEIR's failure to even identify, much less analyze, the impacts on the Valley if the SWRCB were to implement the draft Delta Plan's proposed policy ER P1 and proposed recommendation WR R5.

Proposed policy ER P1 states, among other things, that: (1) the SWRCB should adopt and implement "updated flow objectives for the Delta" by June 2, 2014 and "flow criteria for high-priority tributaries in the Delta watershed" by June 2, 2018; and (2) if the SWRCB were to indicate, by June 30, 2013, that the above target dates could not be met, the Council will consider recommending that the SWRCB "cease issuing water rights permits in the Delta and the watershed." Proposed recommendation WR R5 states:

> The [SWRCB] and/or the Department of Water Resources should require that proponents requesting a new point of diversion, place of use, or purpose of use that results in new or increased use of water from the Delta watershed should demonstrate that the project proponents have evaluated and implemented all other feasible water supply alternatives.

The DEIR fails to analyze, in any way, the impacts that implementation of this proposed policy and recommendation would have in the Sacramento Valley. If implemented – as, in the DEIR's words, "the desired outcome" of the Delta Plan – this proposed policy and recommendation effectively would prevent the Sacramento Valley's communities and farms from using their local water sources to meet their increasing demands unless both: (1) the SWRCB adopts new streamflow requirements reflecting the undefined "more natural flow regime" proposed by the draft Delta Plan; and (2) those communities and farms have implemented "all other feasible water supply alternatives." This apparently "desired outcome" of the draft Delta Plan would, among other things:

- Violate the area-of-origin laws that ensure that the Sacramento Valley's communities and farms will be able to use their local water supplies to meet their growing needs (Water Code §§ 1215-1222, 10505, 10505.5, 11128, 11460-11463, 12200-12220);

- Violate the 2009 Delta Reform Act, which states that it "does not diminish, impair, or otherwise affect in any manner whatsoever any area of origin, watershed of origin, county of origin, or any other water rights protections [or] limit or otherwise affect the application of Article 1.7 (commencing with Section 1215) of Chapter 1 of Part 2 of Division 2 [of the Water Code], Sections 10505, 10505.5, 11128, 11461, 11462, and 11463, and Sections 12200 to 12220, inclusive;"

- Force Sacramento Valley communities and farms to pump significantly more groundwater, potentially: (A) changing the Valley from an area with stable groundwater levels (see draft Delta Plan, p. 91) to one with serious groundwater overdrafts; and (B) inducing significant increases in GHG emissions associated with the increased electrical demands created by the additional groundwater pumping;

- Induce urban and agricultural growth in other areas of the state as a result of artificial water-based constraints on growth in the Sacramento Valley, with associated impacts to air quality, traffic, housing, public services, wetlands, sensitive species habitat, noise and other environmental concerns in those other areas; and

- Prevent the implementation of new management methods intended to further both economic and environmental interests through revised water project operations, such as the Yuba River Accord, which could not be implemented without the SWRCB's approval of changes to Yuba County Water Agency's water-right permits (see SWRCB Corrected Order 2008-0014).

In short, CEQA does not allow the Council to issue specific policy proposals like policy ER P1 and recommendation WR R5 and then fail to analyze their specific impacts under the theory that the Council's EIR must only analyze the impacts of others' projects. By not analyzing the specific impacts of policy ER P1 and recommendation WR R5 on the Sacramento Valley's communities and farms – which, unlike other parts of California, have no choice but to depend on their local water sources to meet growing demands – the DEIR violates CEQA.

NCWA stands ready to meet with you or your staff to clarify these comments, should you have questions.

Sincerely yours,

David J. Guy
President

Cc: Joe Grindstaff, Executive Officer

Water and Power Policy Group

Hydrologic Modeling Results and Estimated Potential Hydropower Effects Due to the Implementation of the State Water Resources Control Board Delta Flow Criteria

December 2011

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*** State and Federal Contractors Water Agency**

*** San Joaquin River Group**

*** Western Area Power Authority**

*** Pacific Gas and Electric Company**

*** Sacramento Municipal Utilities District**

*** Redding Electric Utility**

*** Association of California Water Agencies**

*** Placer County Water Agency**

Northern California Power Agency

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Yuba County Water Agency

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1.0 INTRODUCTION

At the direction of the Water and Power Policy Group, the HDR Team investigated the potential effects of implementing the SWRCB DFC. This product does not constitute the culmination of this project, but it does provide a marker from which further effort may proceed. To this end, we have identified hydropower effects caused by the alternative flow criteria on the CVP and SWP, as well as analyzed hydropower effects on San Joaquin River tributaries. It is our belief that a great percentage of the statewide hydropower effects can be identified by this level of analysis.

This document summarizes our analysis of potential effects the State Water Resources Control Board Delta Flow Criteria (SWRCB DFC) may have on CVP/SWP operations, San Joaquin River operations, and hydropower.

This document consists of the following sections:

- Definition of SWRCB DFC and those included in this analysis
- Summary of conclusions and modeling results
- Analytical approach
- Detailed modeling results

1.1 Background

To analyze the potential effects that the SWRCB DFC may have on hydropower, the following SWRCB DFC were analyzed:

- Delta Outflow Recommendation (75 percent of unimpaired flow from January through June).
- Sacramento River at Rio Vista (75 percent of unimpaired flow from November through June).
- San Joaquin River at Vernalis (60 percent of unimpaired flow from February through June).
- Old and Middle River (OMR) flow criteria (> than -1500 cfs in dry and critical years).

1.1.1 Delta Outflow Recommendation

The Delta Outflow Recommendation of 75 percent of unimpaired from January through June, and the unimpaired flow is used to determine flow requirements. Delta Smelt Fall X2 is included in the Existing (BO's) and as part of the SWRCB DFC. Data is provided in **Figure 1;** *Source: Table 20 Delta Outflow Summary Criteria, California Department of Water Resources Report, California Central Valley Unimpaired Flow Data, Fourth Edition, November 2006.*

Figure 1 – Delta Outflow Summary Criteria.

Table 20. Delta Outflow Summary Criteria

Delta Outflow Recommendations	
Category A	
Water Year (O N D J F M A M J J A S)	**Criteria**
	1) Net Delta Outflow: 75 percent of 14-day average unimpaired flow
Category B	
Water Year (O N D J F M A M J J A S)	**Criteria**
	2) Delta Smelt Fall X2 a. Wet years X2 less than 74 km (greater than approximately 12,400 cfs) b. Above normal years X2 less than 81 km (greater than approximately 7,100 cfs)
	3) 2006 Bay-Delta Plan Delta Outflow Objectives (critical, dry and below normal years)

Basis for Criteria and Explanation

1) Promote increased abundance and improved productivity (positive population growth) for Longfin Smelt and other desirable estuarine species
2) Increase quantity and quality of habitat for Delta Smelt; Fall X2 requirement limited to above normal and wet years to reduce potential conflicts with cold water pool storage, while promoting variability with respect to fall flows and habitat conditions in above normal and wet water year types; expected to result in improved conditions for Delta Smelt, however, the statistical relationship between Fall X2 and abundance is not strong; note 2) above regarding need for improved understanding concerning the Fall X2 action also applies
3) Fish and wildlife beneficial use protection

Notes:

- These flow criteria do not consider any balancing of public trust resource protection with public interest needs for water.
- All flows are subject to appropriate ramping rates to avoid ramping impacts to public trust resources.
- These flow recommendations should be tempered by tributary specific flow needs and the need to manage cold-water resources for the protection of public trust resources.
- Criteria for percentages of unimpaired flows apply only up to a specified maximum cap; appropriate maximum flow caps still need to be determined based on public trust needs and to avoid flooding.
- Additional flows may be needed for the protection of public trust resources for periods of time for which no flow criteria are recommended or where 2006 Bay-Delta Plan flow objectives are recommended, but adequate information is not available at this time to recommend such flows.

Included in analysis

Included in Baseline

1.1.2 Sacramento River

The Sacramento River requirement is modeled as 75 percent of unimpaired Sacramento River at Hood, plus an unimpaired Yolo Bypass flow into the Delta from November through June, rather than at Rio Vista. This model is more conservative (using less water) in comparison if it were modeled at Rio Vista.

The meeting 75 percent of unimpaired flow at Rio Vista requires the Sacramento River and the Yolo Bypass to be at 88 to 100 percent of the unimpaired flow, due to Cross Channel and the Georgiana Slough flow. The Rio Vista flow requires is included in the BO's as part of the SWRCB DFC. However, the Wilkins Slough and the Freeport flows of 13,000 to 17,000 cfs were not analyzed. Data is provided in **Figure 2;** *Source: Table 21 Sacramento River Inflow Summary Criteria, California Department of Water Resources Report, California Central Valley Unimpaired Flow Data, Fourth Edition, November 2006.*

Figure 2 – Sacramento River Inflow Summary Criteria

Table 21. Sacramento River Inflow Summary Criteria

Sacramento River	
Category A	
Water Year (O N D J F M A M J J A S)	**Criteria**
	1) Rio Vista: 75 percent of 14-day average unimpaired flow
Category B	
Water Year (O N D J F M A M J J A S)	**Criteria**
	2) Rio Vista: 75 percent of 14-day average unimpaired flow to support same functions as #1 for other runs of Chinook salmon
	3) Wilkins Slough: Provide pulse flows of 20,000 cfs for 7 days starting in November coinciding with storm events producing unimpaired flows at Wilkins Slough above 20,000 cfs until monitoring indicates that majority of smolts have moved downstream
	4) Freeport: Positive flows in Sacramento River downstream of confluence with Georgiana Slough while juvenile salmon are present (approximately 13,000 to 17,000 cfs)
	5) Sacramento River at Rio Vista: 2006 Bay-Delta Plan flow objectives

Included in analysis

Included in Baseline

Basis for Criteria and Explanation, and Notes

1) Increases juvenile salmon outmigration survival for fall-run Chinook salmon
2) Promote juvenile salmon emigration for other runs of Chinook salmon
3) Increases juvenile salmon outmigration survival by reducing diversion into Georgiana Slough and the central Delta
4) Increases juvenile salmon outmigration survival
5) Fall adult Chinook salmon attraction flows

Notes:

- These flow criteria do not consider any balancing of public trust resource protection with public interest needs for water.
- All flows are subject to appropriate ramping rates to avoid ramping impacts to public trust resources.
- These flow recommendations should be tempered by tributary specific flow needs and the need to manage cold-water resources for the protection of public trust resources.
- Criteria for percentages of unimpaired flows apply only up to a specified maximum cap; appropriate maximum flow caps still need to be determined based on public trust needs and to avoid flooding.
- Additional flows may be needed for the protection of public trust resources for periods of time for which no flow criteria are recommended or where 2006 Bay-Delta Plan flow objectives are recommended, but adequate information is not available at this time to recommend such flows.

[1] Definition of storm, number of storms, and how to determine when the majority of juveniles have outmigrated needs to be determined.

1.1.3 San Joaquin River

The San Joaquin Rivera at Vernalis was analyzed at 60 percent of unimpaired flow from February through June. Data is provided in **Figure 3;** *Source: Table 22 San Joaquin River Inflow Summary Criteria, California Department of Water Resources Report, California Central Valley Unimpaired Flow Data, Fourth Edition, November 2006.*

Figure 3 – San Joaquin River Inflow Summary Criteria

Table 22. San Joaquin River Inflow Summary Criteria

San Joaquin River												
Category A												
Water Year												**Criteria**
O	N	D	J	F	M	A	M	J	J	A	S	
												1) Vernalis: 60 percent of 14-day average unimpaired flow
												2) Vernalis: 10 day minimum pulse of 3,600 cfs in late October (e.g., October 15 to 26)
Category B												
Water Year												**Criteria**
O	N	D	J	F	M	A	M	J	J	A	S	
												3) 2006 Bay-Delta Plan October pulse flow

Included in analysis

Included in Baseline

Basis for Criteria and Explanation, and Notes

1) Increase juvenile Chinook salmon outmigration survival and provide conditions that will generally produce positive population growth in most years and achieve the doubling goal in more than half of years
2) Minimum adult Chinook salmon attraction flows to decrease straying, increase DO, reduce temperatures, and improve olfactory homing fidelity
3) Adult Chinook salmon attraction flows

Notes:

- These flow criteria do not consider any balancing of public trust resource protection with public interest needs for water.
- All flows are subject to appropriate ramping rates to avoid ramping impacts to public trust resources.
- These flow recommendations should be tempered by tributary specific flow needs and the need to manage cold-water resources for the protection of public trust resources.
- Criteria for percentages of unimpaired flows apply only up to a specified maximum cap; appropriate maximum flow caps still need to be determined based on public trust needs and to avoid flooding.
- Additional flows may be needed for the protection of public trust resources for periods of time for which no flow criteria are recommended or where 2006 Bay-Delta Plan flow objectives are recommended, but adequate information is not available at this time to recommend such flows.

1.1.4 Old and Middle River, Inflow-Export Ratios, and Jersey Point

The Old and Middle River (OMR) did not analyze San Joaquin River flow to export ratio. The OMR included flows included in the BO's and the SWRCB DFC (**Figure 4**: *Source: Table 23: No. 4-6, Hydrodynamics Summary Criteria, California Department of Water Resources Report,* *California Central Valley Unimpaired Flow Data, Fourth Edition, November 2006).* The Jersey Point criteria is not addressed in the data.

Figure 4 - Hydrodynamics Summary Criteria

Table 23. Hydrodynamics Summary Criteria

Hydrodynamics: Old and Middle River, Inflow-Export Ratios, and Jersey Point	
Category A	
Water Year (O N D J F M A M J J A S)	**Criteria**
	1) San Joaquin River Flow to Export Ratio: Vernalis flows to exports greater than 0.33 during fall pulse flow (e.g., October 15 – 26); complementary action to San Joaquin River Inflow recommendation #2
Category B	
Water Year (O N D J F M A M J J A S)	**Criteria**
	2) Old and Middle River Flows: greater than -1,500 cfs in Critical and Dry water years
	3) Old and Middle River Flows: greater than 0 or -1,500 cfs in Critical and Dry water years, when FMWT index for longfin smelt is less than 500, or greater than 500, respectively
	4) Old and Middle River Flows: greater than -5,000 cfs in all water year types
	5) Old and Middle River Flows: greater than -2,500 when salmon smolts are determined to be present in the Delta
	6) San Joaquin River Flow to Export Ratio: Vernalis flows to exports greater than 4.0 when juvenile San Joaquin River salmon are migrating in mainstem San Joaquin River
	7) Jersey Point: Positive flows when salmon present in the Delta
	8) 2006 Bay-Delta Plan Exports to Delta Inflows
Basis for Criteria and Explanation	

1) Reduce straying and improve homing fidelity for San Joaquin basin adult salmon
2) Reduce entrainment of larval / juvenile delta smelt, longfin smelt, and provide benefits to other desirable species
3) Same as number 2), but if the previous FMWT index for longfin smelt is less than 500, then OMR must be greater than 0 (to reduce entrainment losses when abundance is low), or greater than -1,500 if the previous FMWT index for longfin smelt is greater than 500
4) Reduce entrainment of adult delta smelt, longfin smelt, and other species; less negative flows may be warranted during periods when significant portions of the adult smelt population migrate into the south or central Delta; thresholds for such flows need to be determined
5) Reduce risk of juvenile salmon entrainment and straying to central Delta at times when juveniles are present in the Delta; will also provide associated benefits for adult migration
6) Improve survival of San Joaquin River juvenile salmon emigrating down the San Joaquin River and improve subsequent escapement 2.5 years later
7) Increase survival of outmigrating smolts, decrease diversion of smolts into central Delta where survival is low, and provide attraction flows for adult returns
8) Protection of estuarine dependent species

(cont.)

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2.0 OVERVIEW

The analytical approach used for this effort was the latest publically available version of the CalSim II model. This version was used by the DWR to develop its 2009 State Water Program (SWP) Reliability Study, published by DWR on January 29, 2010.

The version was ideal for the application, because it was used to evaluate criteria submitted to the SWRCB during its Delta proceeding, and it has been used by members of the consultant team to evaluate the final criteria developed by the SWRCB.

The baseline CalSim II Study (BST_2005A01A_Existing_DRR_2Step) includes reasonable and prudent alternatives (RPAs) contained in the 2008 Fish and Wildlife Service Biological Opinion for the Coordinated Operations and the 2009 National Marine Fisheries Service Biological Opinion for OCAP.

The SWRCB DFC criteria's described above are input into the CalSim II Existing Conditions (BO's) model simulation to develop a model simulation with the SWRCB DFC. These model simulations are compared to derive changes to the water system, and then determine the hydropower impacts.

2.1 Summary of the State Water Resources Control Board Delta Flow Criteria Impacts

Table 1 – Summary of SWRCB DFC Impacts

Description	Impacts
Four of the SWRCB DFCs were analyzed, and assumptions made that imposed less onerous burden on water system.	▪ Effects to the water system were very severe, resulting in the inability to produce viable operations.
Increase in Delta Outflow	▪ There was approximately at 5 MAF of increased Delta outflow.
Significant and regular cuts	▪ Senior Water Rights holders (including pre-1914, Sacramento Settlement, and Exchange contractors, are cut regularly and significantly
Devastating decrease in project deliveries	▪ M&I South of Delta – 1.1 MAF = 2.5 Million households. ▪ Agriculture – 2 Million acres out of production (7000,000 + North, 1 Million + South).
Unable to meet biological opinions	▪ Impossible to meet salmon and smelt criteria. ▪ Cannot meet existing flow standards, including SWRCB D-1641.
Upstream storage	▪ Lower storage in all seasons. ▪ Fish habitat and cold water pool heavily impacted. ▪ Reduced hydropower capacity caused by loss in head.
State-wide impacts	▪ Impacts to groundwater storage. ▪ Reduced ability for conjunctive management. ▪ Impacts to Ephemeral streams and habitats.
Pacific Flyway Delivery	▪ Significant reduction in refuge delivery effective Pacific Flyway.

Description	Impacts
CVP/SWP Hydropower Generation	▪ A 30% average annual reduction in combined CVP/SWP generation. ▪ Change in timing (generation shifted to spring months when already surplus power in the system. ▪ Reduction in summer and fall months. ▪ Spring energy production is 50% greater with the SWRCB DFC than with the existing conditions. ▪ Summer energy production with the SWRCB DFC is about 50% less than with existing. ▪ Shift in timing of generation will produce economic cost. ▪ Summer generation value is 30% greater than on an MWh basis.
CVP/SWP Hydropower Generation Cost	▪ At 12,000 KWh/year/household the average annual generation reduction is equivalent to nearly 250,000 households each year.
CVP/SWP Load	▪ A decrease in Delta exports. ▪ A decrease in project use load, but will require additional energy for desalination of replacement water (greater than the project use load), savings by 2,000 GWh – at 12,000 KWh/year/household the average annual additional energy for desolation is equivalent to nearly 165,000 households per year. ▪ Replacement power costs will be 200 percent more costly than project power.
San Joaquin Tributary Hydropower Generation	▪ Don Pedro – Overall reduction in annual generation of 23% (135 GWH) ▪ Exchequer – Overall reduction in annual generation of 26% (90 GWH)
San Joaquin Tributary Hydropower Generation Cost	▪ At 12,000 KWh/year/household the average annual Don Pedro generation reduction is equivalent to over 11,000 households each year. ▪ At 12,000 KWh/year/household the average annual Exchequer generation reduction is equivalent to 7,500 households each year.

Figure 5 – Summary of Changes in Delta Boundary Flows – SWRCB DFC minus Existing (BO's). Average Annual Changes by 40-30-30 Water Year Type (MAF).

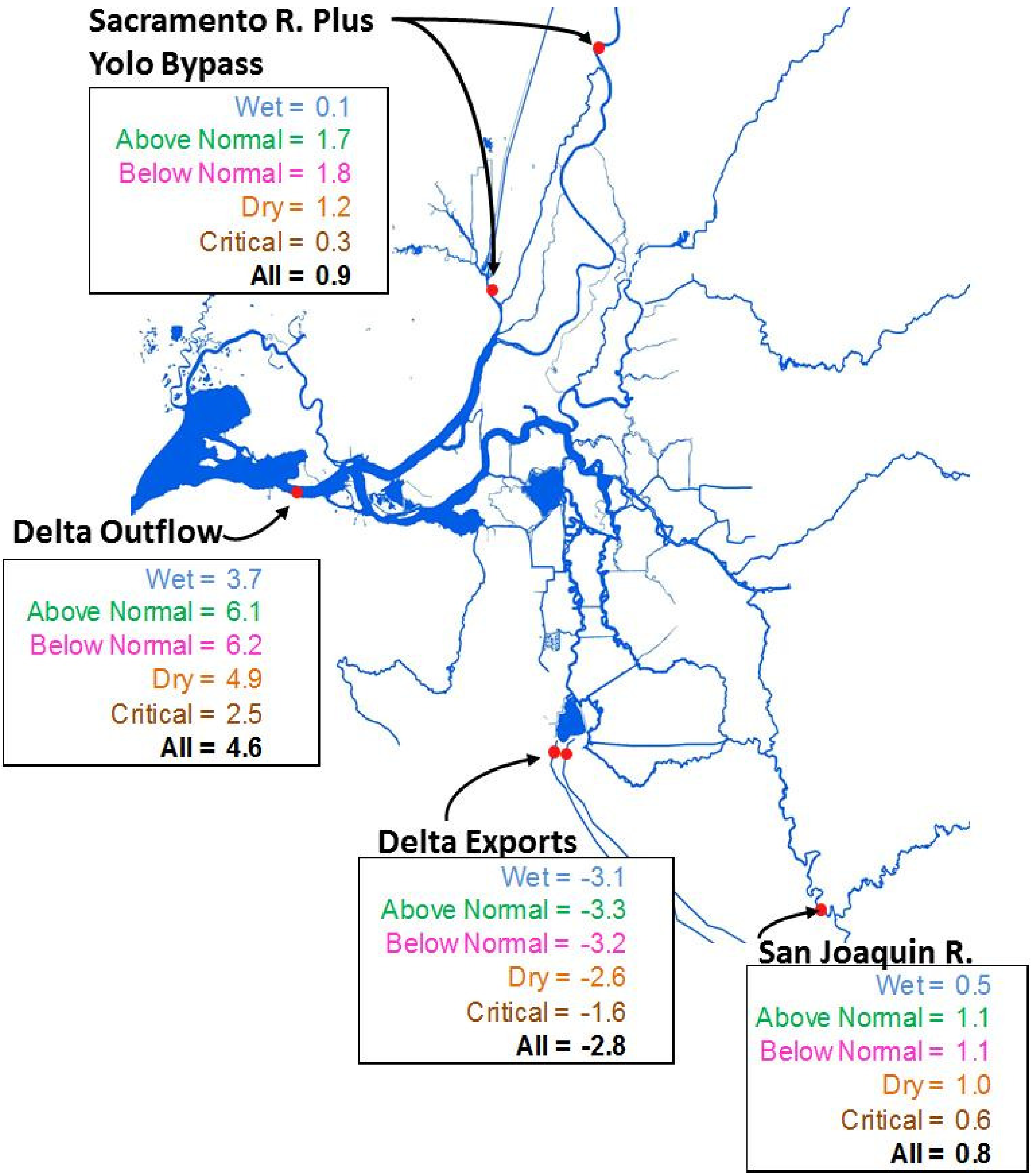


Figure 6 - Summary of Changes in Key River flows - SWRCB DFC minus Existing (BO's). Average Monthly Changes by 40-30-30 Water Year Type (cfs).

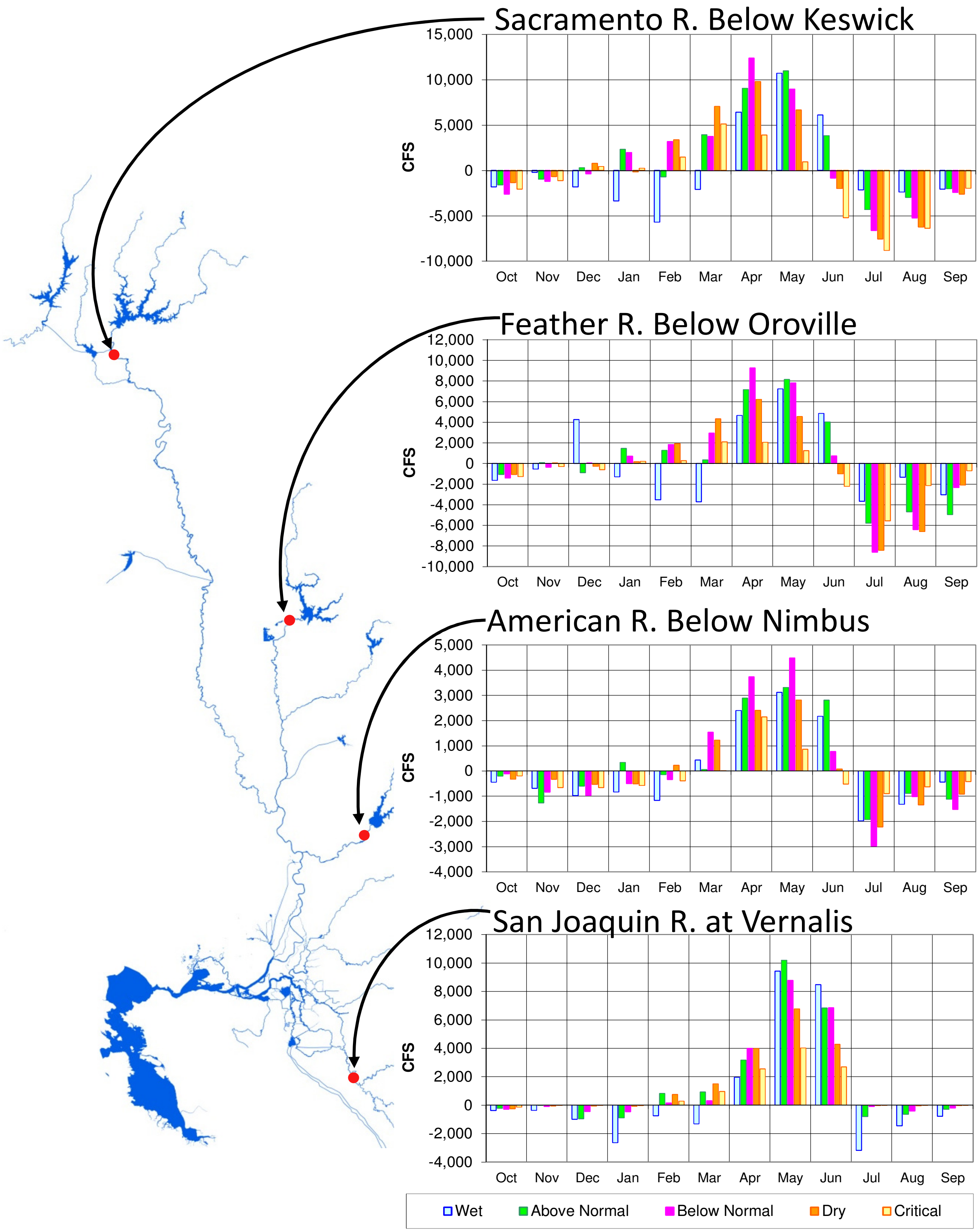


Figure 7 – Summary of Changes in Delta Boundary Flows – SWRCB DFC minus Existing (BO's). Average Monthly Changes by 40-30-30 Water Year Type (cfs).

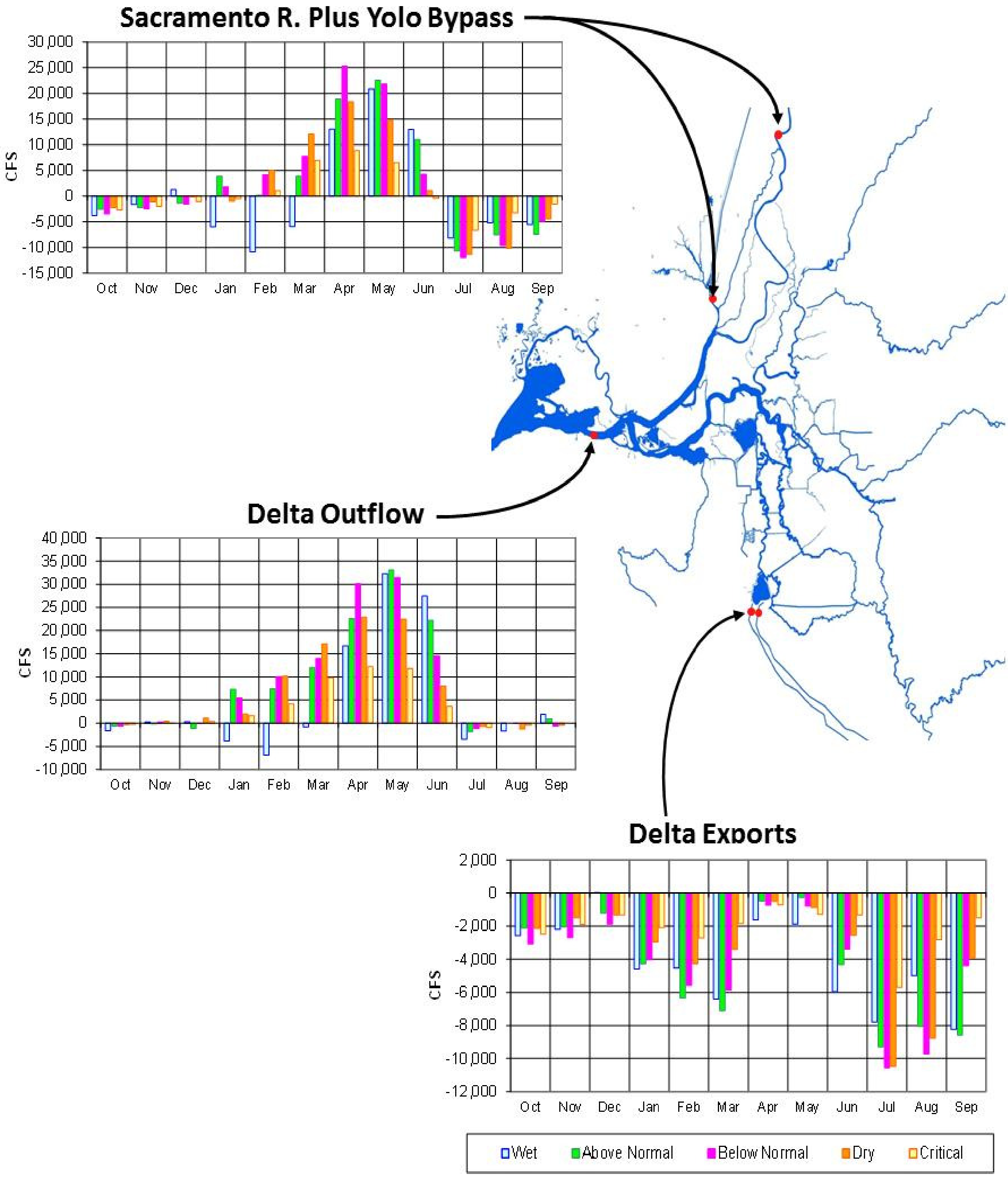
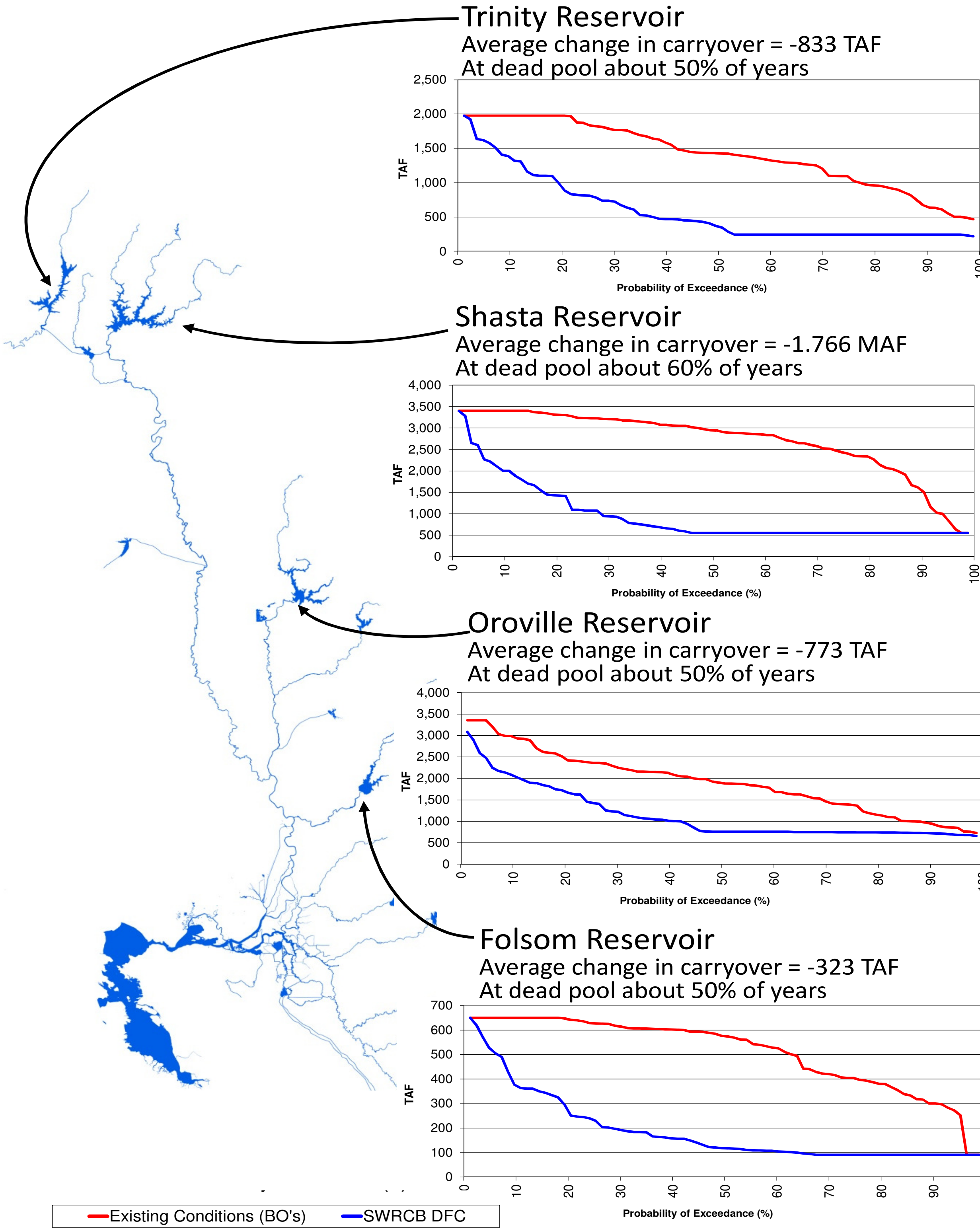


Figure 8 - Summary of Main CVP/SWP Reservoir Carryover - SWRCB DFC and Existing (BO's). End of September Storage (TAF).



3.0 ANALYTICAL APPROACH TO HYDROPOWER MODELING

The analytical approach used for this effort was to employ available hydropower models utilizing CalSim II model output from simulations described in Section 2.0. For the CVP hydropower analysis, Reclamation's LongTermGen spreadsheet was used. For the SWP hydropower analysis, DWR's SWPGen spreadsheet was used. Proprietary models for the San Joaquin River tributary hydropower analyses were employed by Daniel B. Steiner, Consulting Engineer, to obtain results for these watersheds.

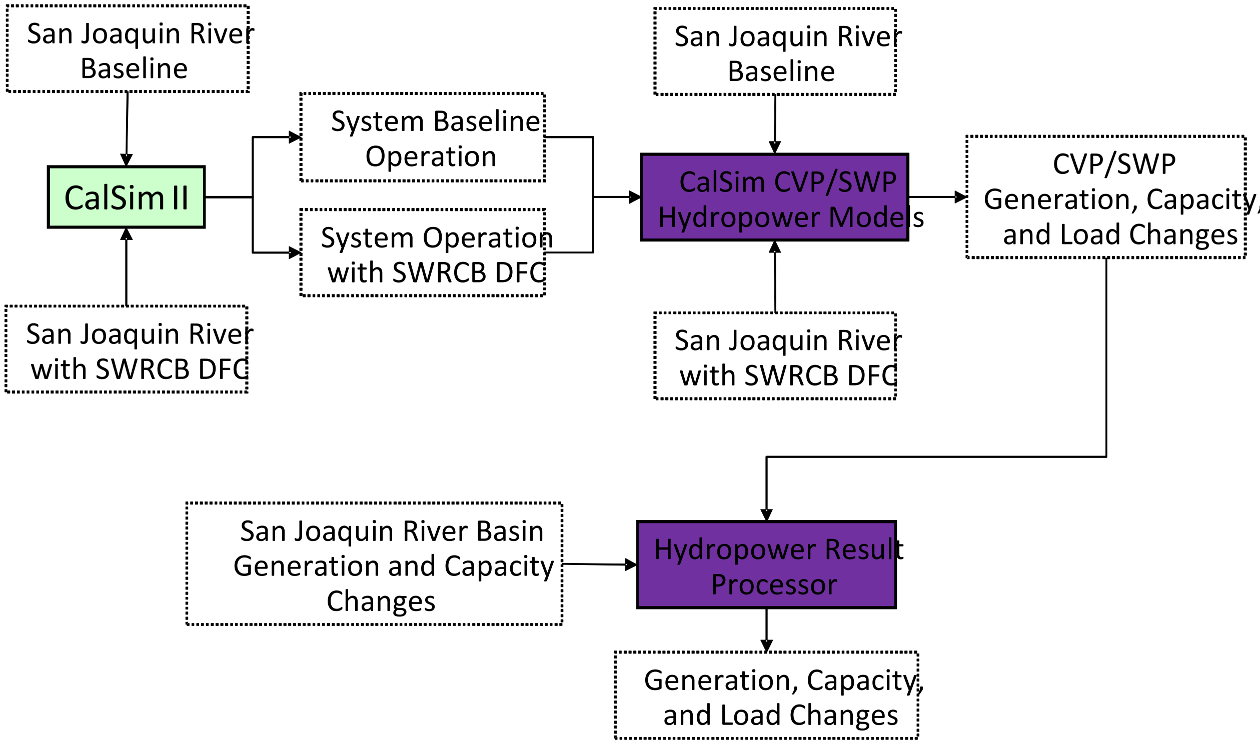
The analysis of the SWRCB DFC was performed using several different models to define both a baseline operations and an operation with the SWRCB DFC. Effects due to the SWRCB DFC are derived by comparing model simulations with and without the SWRCB DFC. The following flowchart illustrates the models used and information passing between models. Components of the flowchart are described in detail in this section.

3.1 CalSim II

CalSim II is a planning model designed to simulate the CVP and SWP water delivery systems while meeting various instream flow requirements, in-basin use obligations, and flood control criteria. The CalSim II model simulation used to support the State Water Project Delivery Reliability Report (SWP DRR) is the best available modeling tool and latest public release of the model. Appendix A of the SWP DRR describes the CalSim II modeling assumptions. For this analysis CalSim II was used to assess changes in CVP / SWP storage, river flows, water deliveries, and Delta conditions. The SWP DRR may be found at the following web location: http://baydeltaoffice.water.ca.gov/swpreliability/Reliability2010final101210.pdf

Besides its public availability, this version is ideal for the application because it has already been used to evaluate criteria submitted to the State Water Resources Control Board (SWRCB) during its Delta proceeding, and it has been used by members of the consultant team to evaluate the final criteria developed by the SWRCB. The baseline CalSim II study (BST_2005A01A_Existing_DRR_2Step) includes reasonable and prudent alternatives (RPAs) contained in the 2008 Fish and Wildlife Service Biological Opinion for the Coordinated Operations and the 2009 National Marine Fisheries Service Biological Opinion for OCAP.

Figure 9 - San Joaquin River Basin Analysis



3.2 CVP/SWP Hydropower Effects

The implementation of the SWRCB DFC creates considerable hydropower effects. These effects though sizeable on a monthly basis are likely to be even greater when brought into the world of real-time operations.

The analyses portrayed in this report are necessarily conducted on a monthly basis because of the limitations on data used for comparative input. These data are the result of CalSim II simulations of SWP/CVP conditions expected to occur in the future with and without the SWRCB DFC. Because CalSim II is constrained by its own input data which only exists on a monthly time step, so therefore is the hydropower analysis possible on a monthly basis.

Hydropower effects obtainable from the models include production; generation (MWH) and capacity (MW) at project power plants; and, energy use (MWH) and demand (MW) at project pumping plants. Not identifiable with these tools are the ancillary services: scheduling and dispatch, reactive power and voltage control, loss compensation, load following, system protection, and energy imbalance.

This report expresses results at Load Center, which is assumed to be at Tracy California. Values shown for load center include adjustments for station service at, and line losses from, power plants as well as station service at and line losses to pumping plants. Reported energy values are averages over the month and capacity values are also head dependent monthly averages.

Given the limitations of a monthly time step, effects of the comparisons are largely identified by the temporal distribution of hydropower production and use along with the annual changes in these quantities.

3.3 San Joaquin River Tributary Hydropower Effects

Analysis of the San Joaquin River Basin was prepared for the San Joaquin River Group Authority by Daniel B. Steiner, Consulting Engineer, and the analysis is described in his February 15, 2011 paper titled: *"Power Operation Impact Analysis Associated with SWRCB Staff Vernalis Flow Requirements."* The purpose of this analysis was to describe the results of preliminary analyses that illustrate quantifiable potential power generation effects of alternative flow requirements applied to the major rim reservoir projects located on the Stanislaus, Tuolumne and Merced rivers. The analysis produced results that illustrate the magnitude of potential effects, in terms of monthly and annual energy production and the seasonal shifts of generation that could occur. These results are derived from models that have been used by the San Joaquin River Group Authority (SJRGA) and its members throughout recent watershed and basin planning efforts. Power generation is modeled as an incidental result of reservoir releases. Generation efficiency (kWh/AF) and capability (MW) curves, based on the reservoir elevation/storage parameter, applied to reservoir releases, provide month to month (or more frequent) generation values for each model's simulation period.

Similar to the discussion on CVP/SWP Hydropower Effects, San Joaquin River Hydropower effects are expressed in the same manner. Although different tools are incorporated into the analyses, the resultant comparisons are presented in the same manner as the CVP/SWP. Exceptions to the above are, however, that no adjustments are made to reflect quantities at the Tracy load center, nor are there any loads identified for these tributary projects.

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4.0 DETAILED ANALYTICAL RESULTS

Changes in the water system and hydropower are characterized by the following parameters:

- Changes in Delta outflow.
- Effectiveness of system to satisfy SWRCB flow requirements and SWRCB DFC.
- Sacramento River Basin flow to Delta.
- Effects on Delta Exports.
- Effects on Sacramento River Basin ground water.
- Effects on Shasta Lake and Upper Sacramento River.
- Effects on Trinity operations.
- Effects on Folsom Lake and the American River.
- Effects on Oroville and the Feather River.
- Effects on the San Joaquin River at Vernalis.
- Effects on San Luis Reservoir operations.
- Effects on CVP / SWP water deliveries.
- Effects on CVP / SWP hydropower generation.
- Effects on CVP / SWP energy load.

4.1 Change in Delta Outflow - SWRCB DFC Minus Existing (BO's)

- Large increases in January through June.
- Decreases in January and February in wet years as reservoirs refill.

Figure 10 - Changes in Delta Outflow - SWRCB DFC Minus Existing (BO's). Average by Year Type

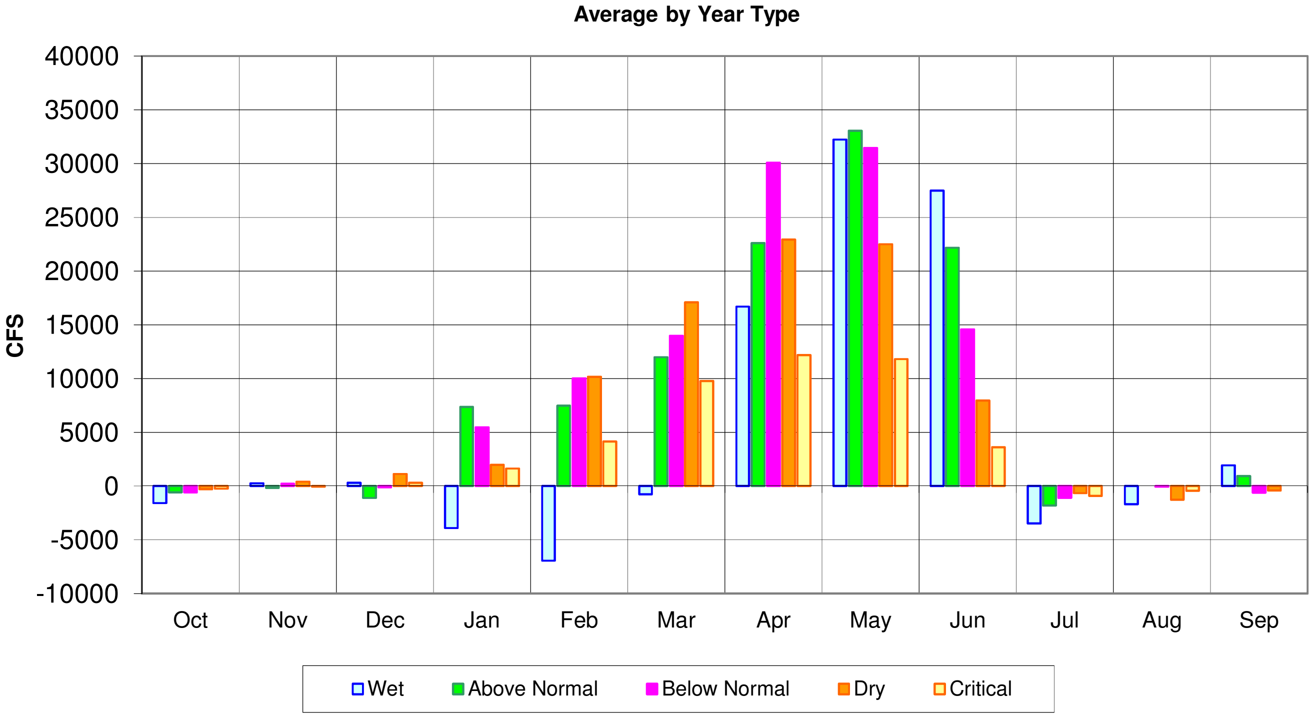


Figure 11 - Annual Change in Delta Outflow - SWRCB DFC minus Existing (BO's). Average increase of 4.6 MAF.

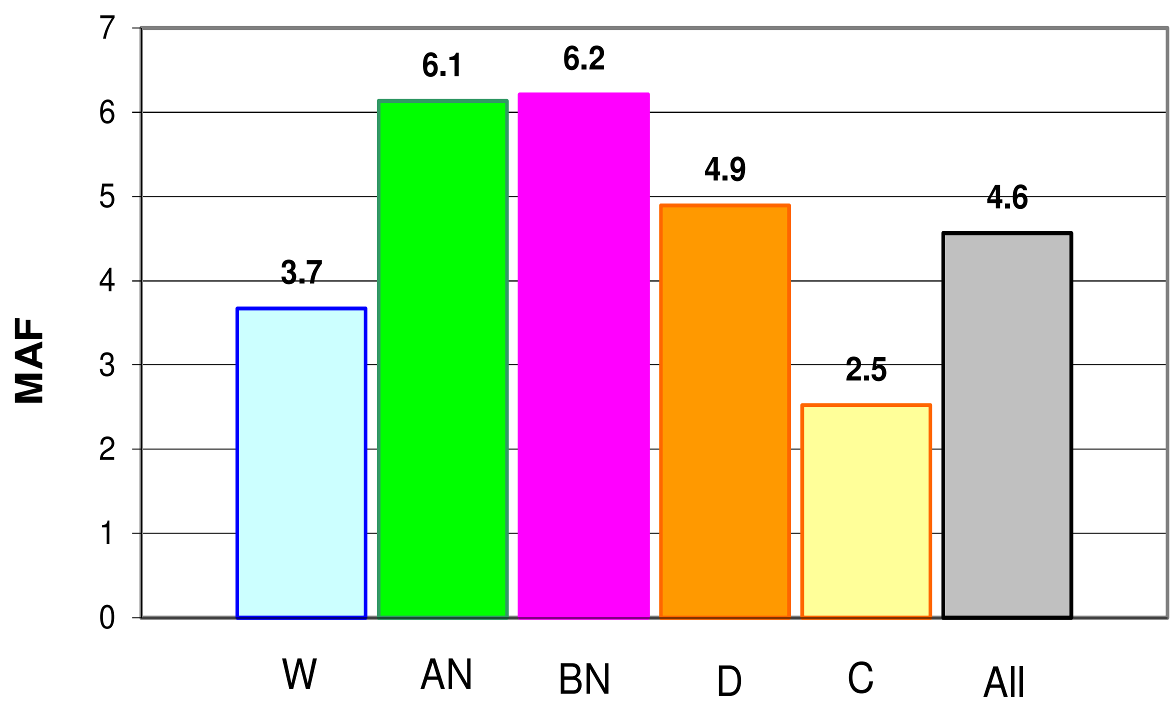
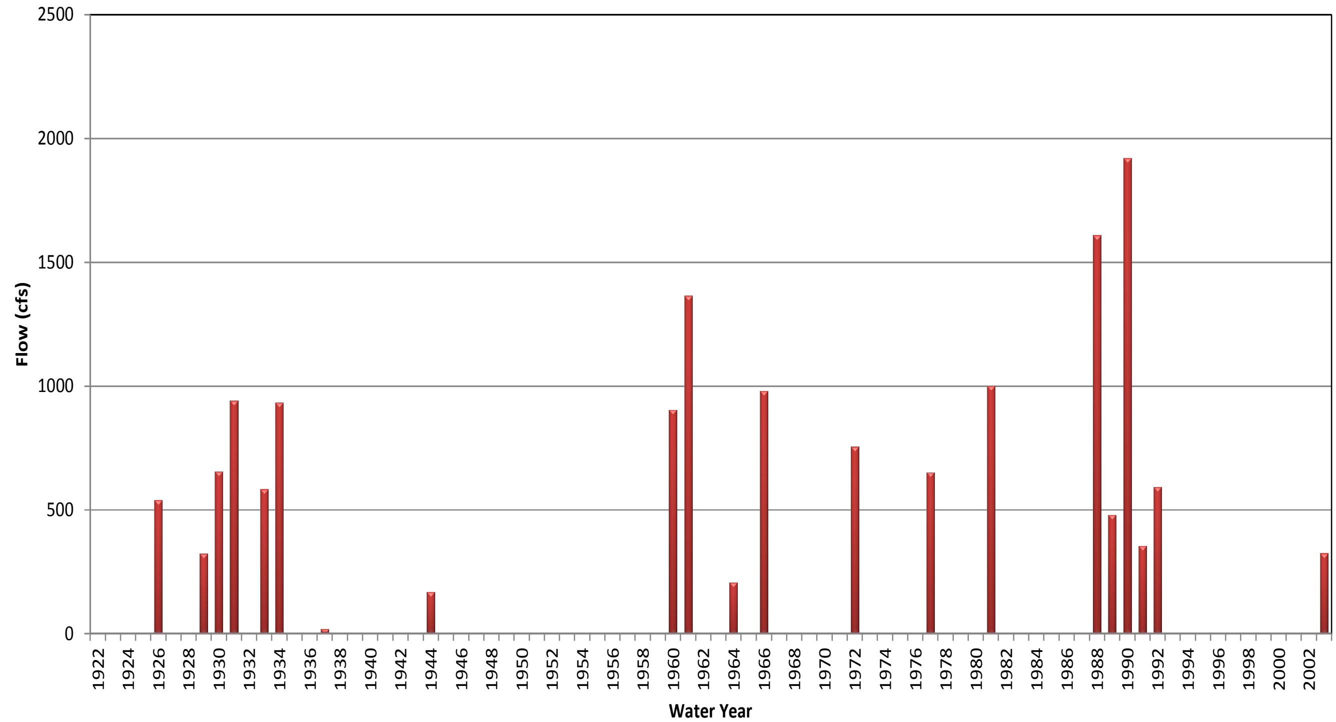
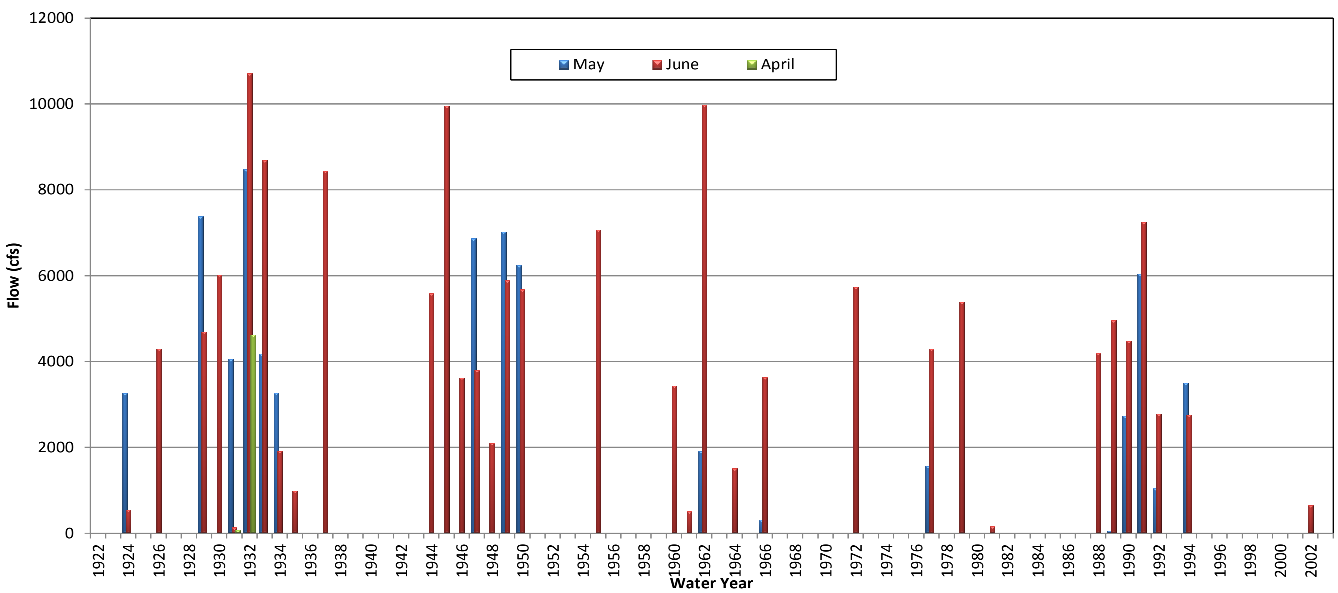


Figure 12 - Violations in D-1641 Delta Outflow Requirements in July in SWRCB DFC Scenario.



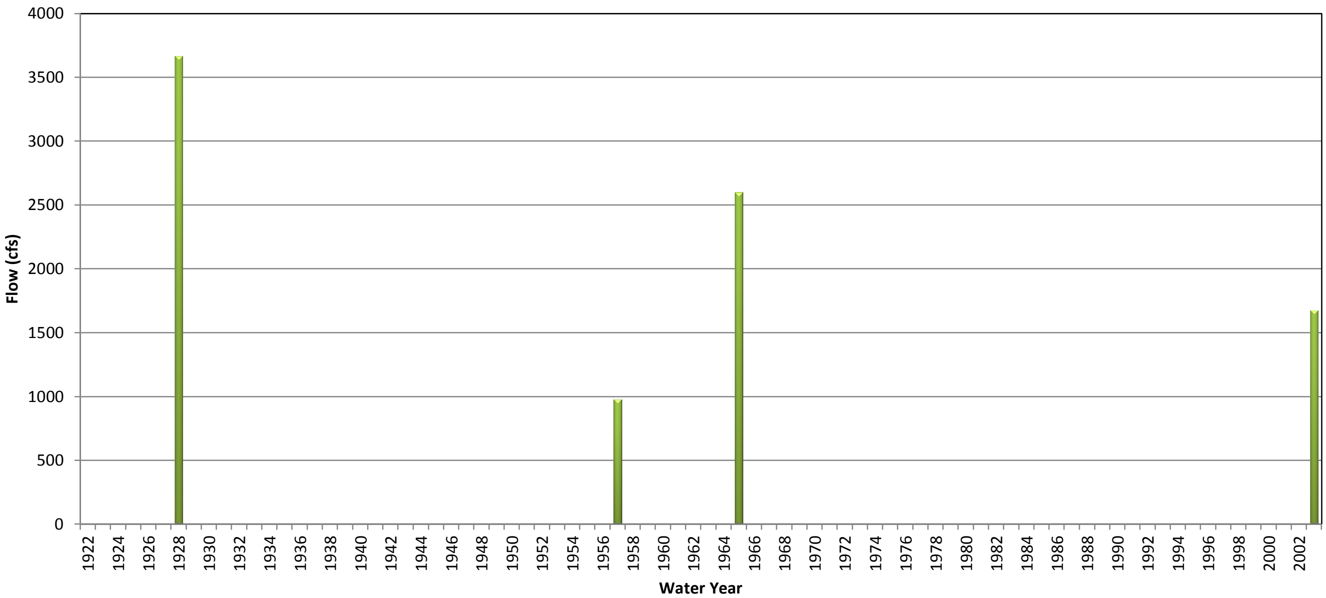
Increases flows in winter and spring cause upstream reservoirs to hit dead pool causing shortage in upstream diversions and inability to satisfy SWRCB D-1641 flow requirements.

Figure 13 - Shortage in Supply to Satisfy SWRCB DFC in April, May, and June.



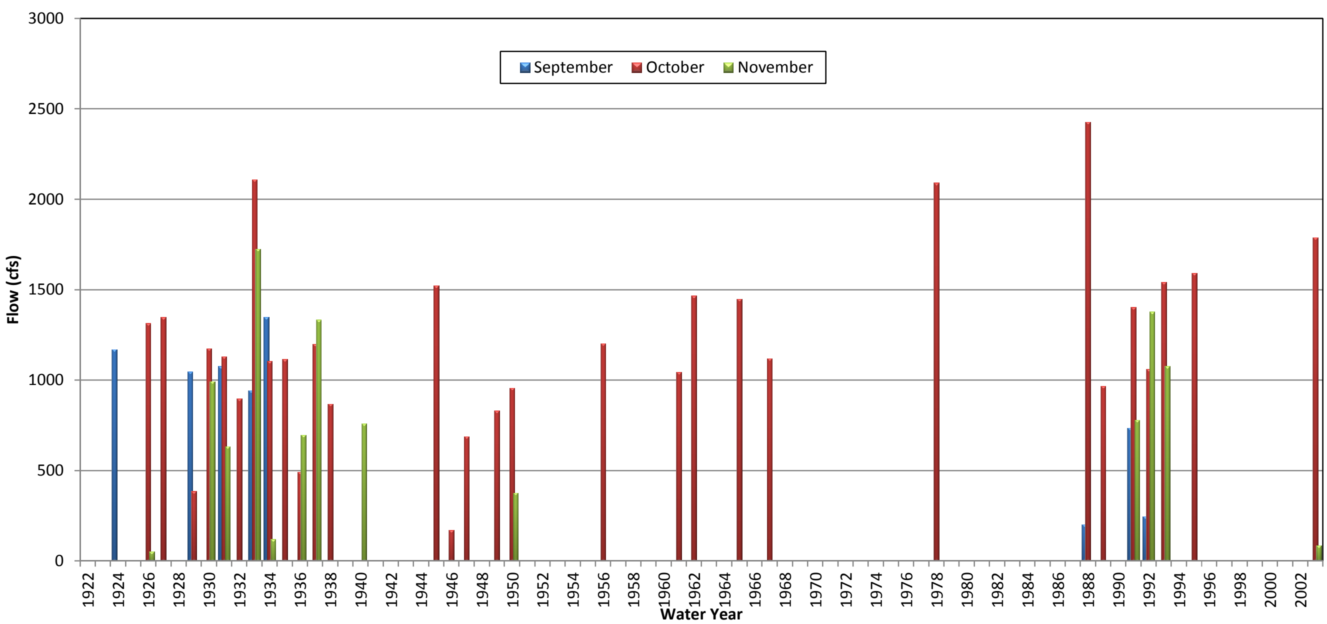
Satisfying the SWRCB DFC along with numerous existing flow requirements result in demands on the system in excess of its ability to satisfy existing requirements and the SWRCB DFC.

Figure 14 – Violation in Smelt Fall X2 RPA in September in SWRCB DFC Scenario



Satisfying the SWRCB DFC cause water shortages leading to inability to meet Fall X2 flows Smelt BO RPA's

Figure 15 – Violations in D-1641 Flow Requirement at Rio Vista in September, October, and November in SWRCB DFC Scenario



Satisfying the SWRCB DFC cause water shortages leading to inability to meet SWRCB D-1641 flow requirements in the Sacramento River during fall months

Figure 16 - Sacramento River Plus Yolo Bypass Inflow to Delta

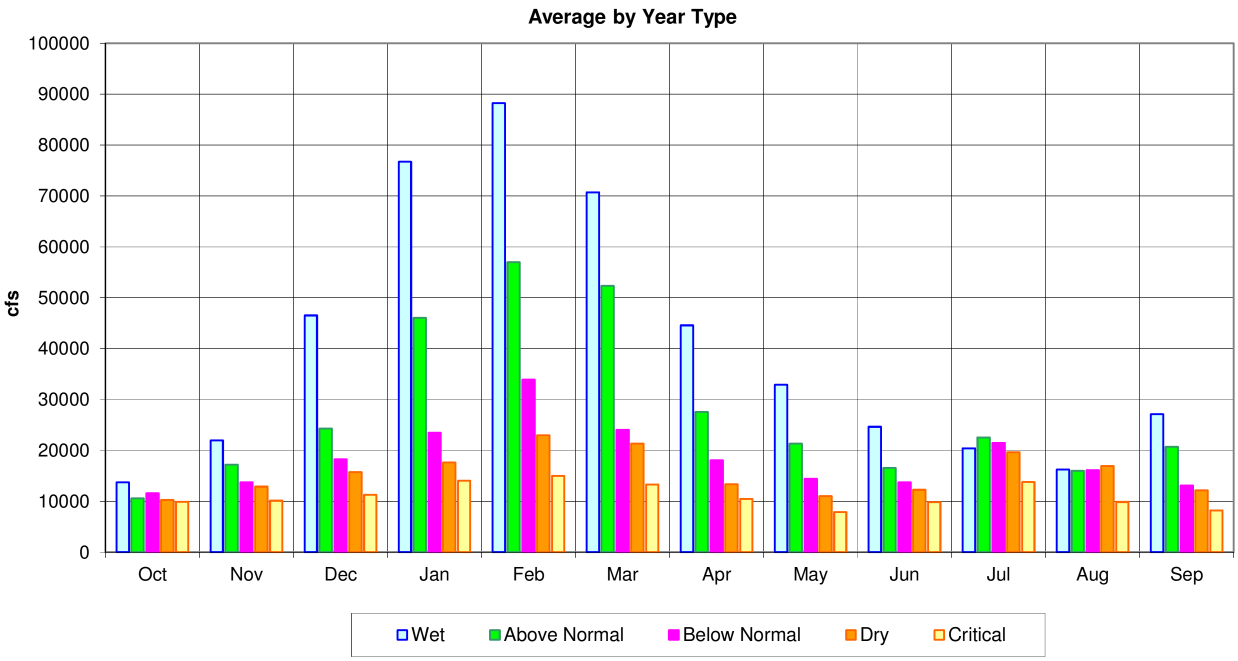
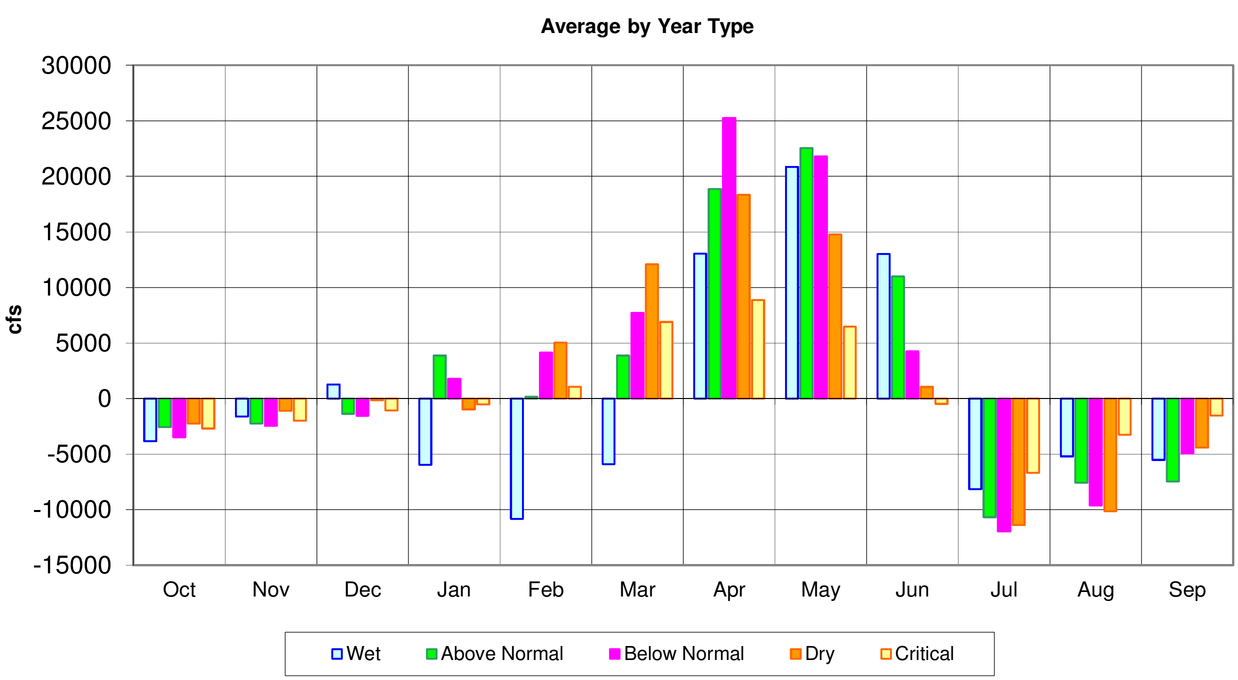
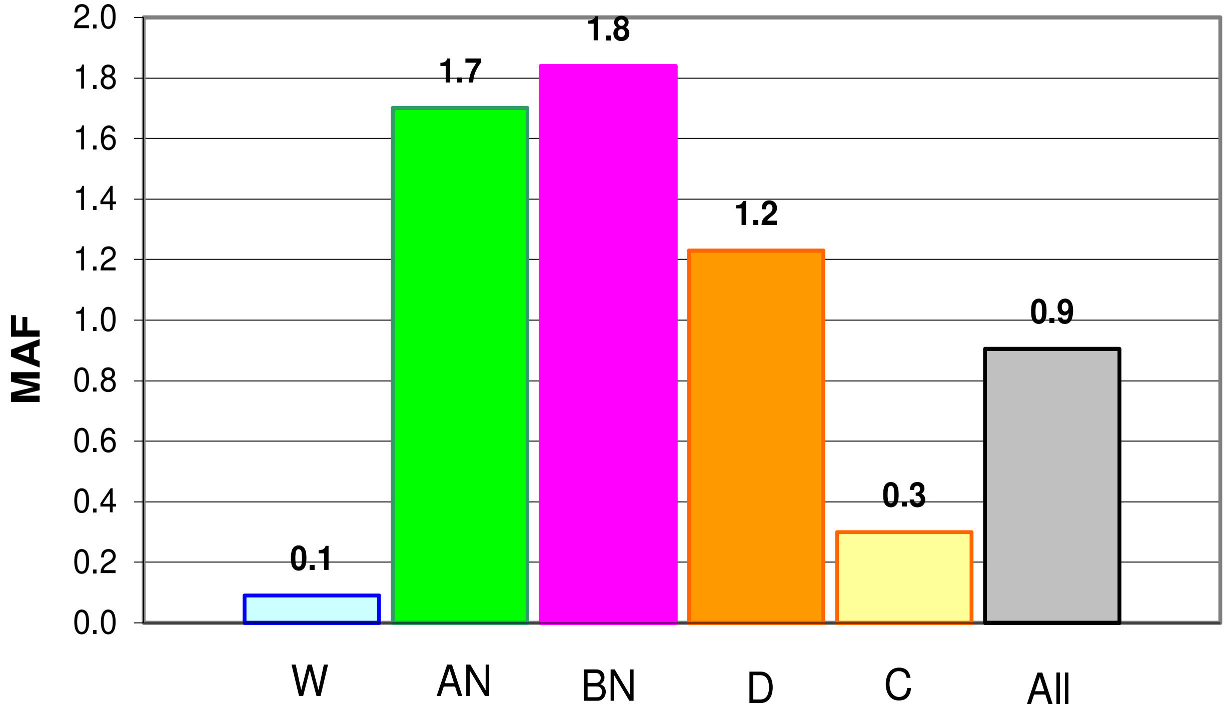


Figure 17 Change in Sacramento River plus Yolo Bypass Inflow to Delta - SWRCB DFC Minus Existing (BO's)



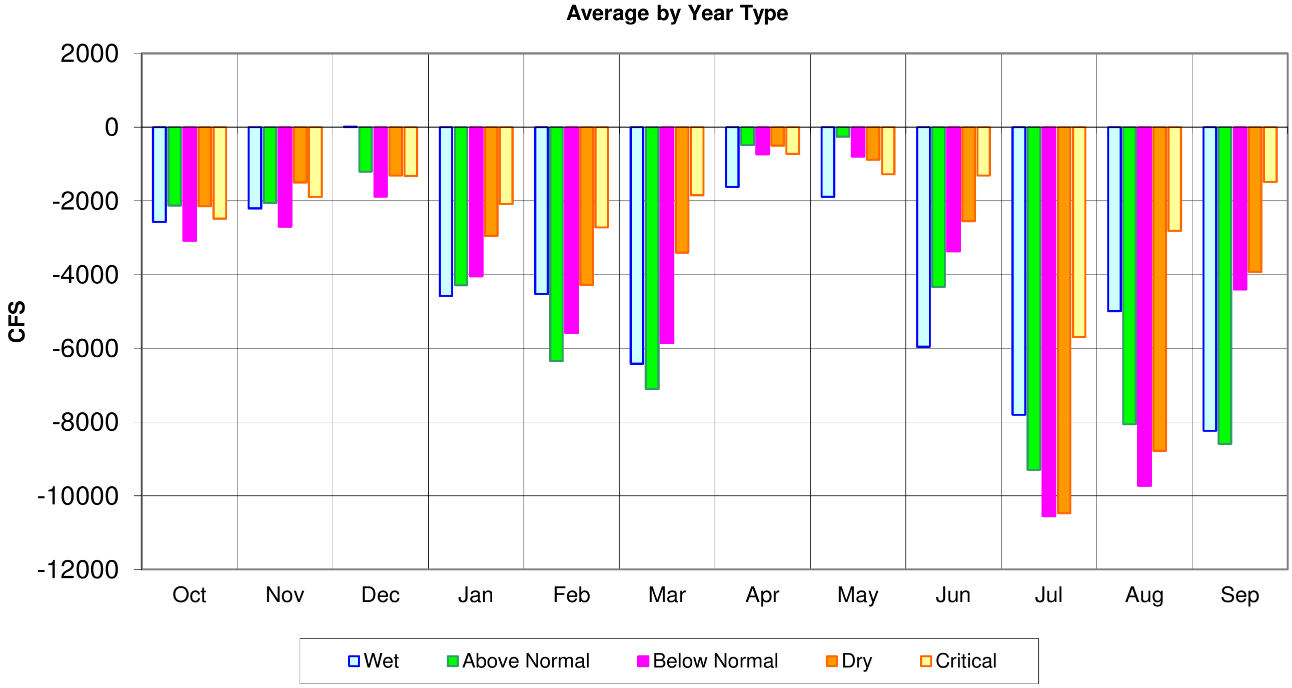
- Large increases in January through June.
- Decreases in January through March in wet years as reservoirs refill.
- Decreases in July through December, mostly due to low upstream reservoir storage but is also due to an assumption that reservoirs do not release additional water to support exports.

Figure 18 - Annual Change in Sacramento River Plus Yolo Bypass Inflow to Delta - SWRCB DFC minus Existing (BO's)



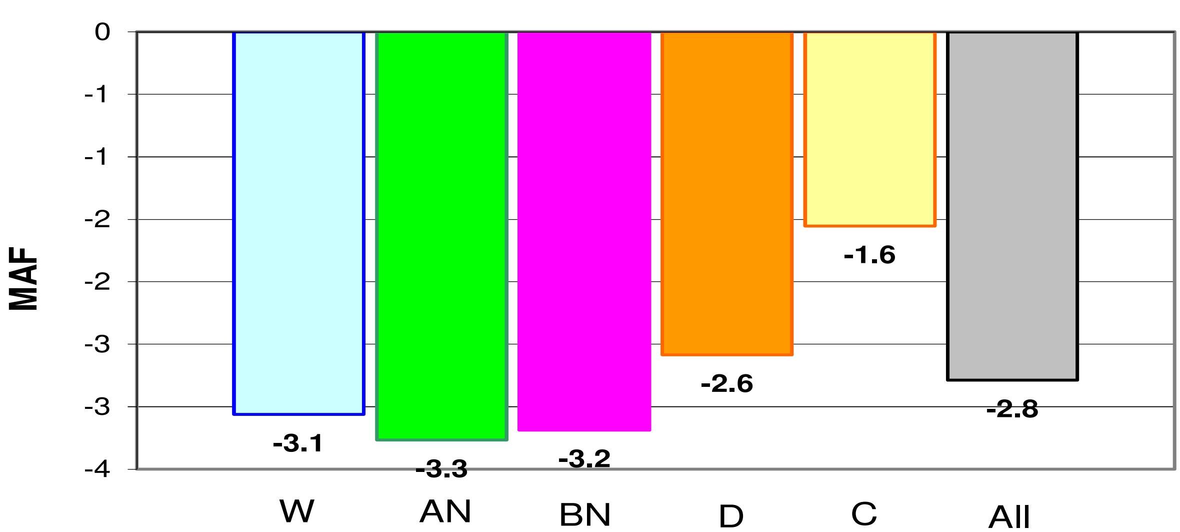
- Average annual increase of 900 TAF.
- Affected by increases in Trinity River import of about 170 TAF.
- Affected by increases in groundwater pumping of about 800 TAF.

Figure 19 - Monthly Change in Delta Exports - SWRCB DFC minus Existing (BO's)



- Delta exports are affected throughout each year and in all types of years.
- No Reservoir releases are made to support Delta export because of low upstream reservoir conditions.

Figure 20 - Annual Change in Delta Exports - SWRCB DFC minus Existing (BO's)



- Average annual Existing (BO's) level export = 4.93 MAF.
- Average annual export with SWRCB DFC = 2.14 MAF.
- Average annual change in export = 2.8 MAF.

4.2 Groundwater Pumping in Sacramento Valley

CalSim II is not designed to simulate CVP/SWP operations using criteria as onerous as the SWRCB DFC. Therefore, the model simulation produced using the SWRCB DFC overestimates changes in groundwater pumping. The level of increased pumping simulated in the model is not physically possible.

Although the model increases groundwater pumping to satisfy all demands, there would most likely be a reduction in crop acreage and refuge water supply, and any increase in groundwater pumping will likely result in lower groundwater tables, and increases in groundwater recharge (similar in magnitude to the increase in pumping). This increase in recharge would result in decreases in stream flow that would cause additional need for groundwater pumping, reservoir releases, and crop fallowing to satisfy the SWRCB DFC. It is also believed that decreases in groundwater levels would cause adverse impacts to ephemeral stream habitat, urban wells, and major surface water streams.

Figure 21 - Monthly Change in Groundwater Pumping in Sacramento Valley - SWRCB DFC minus Existing (BO's)

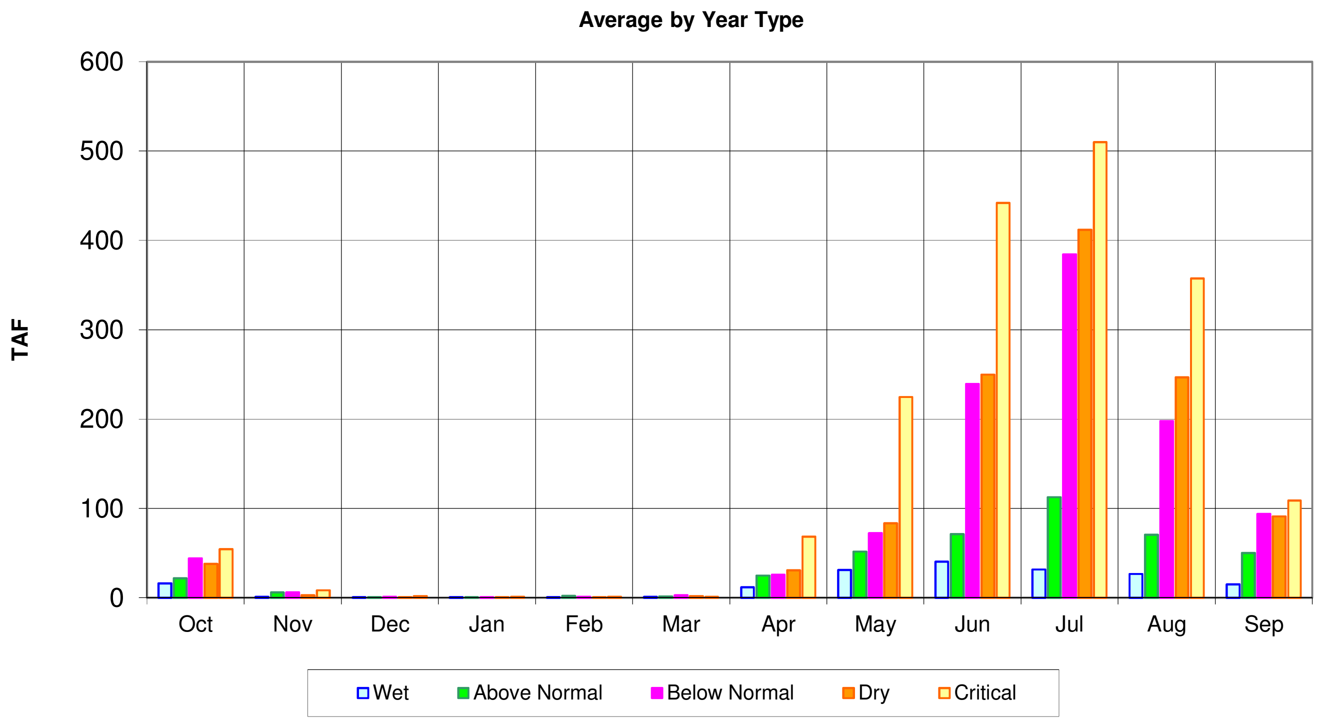
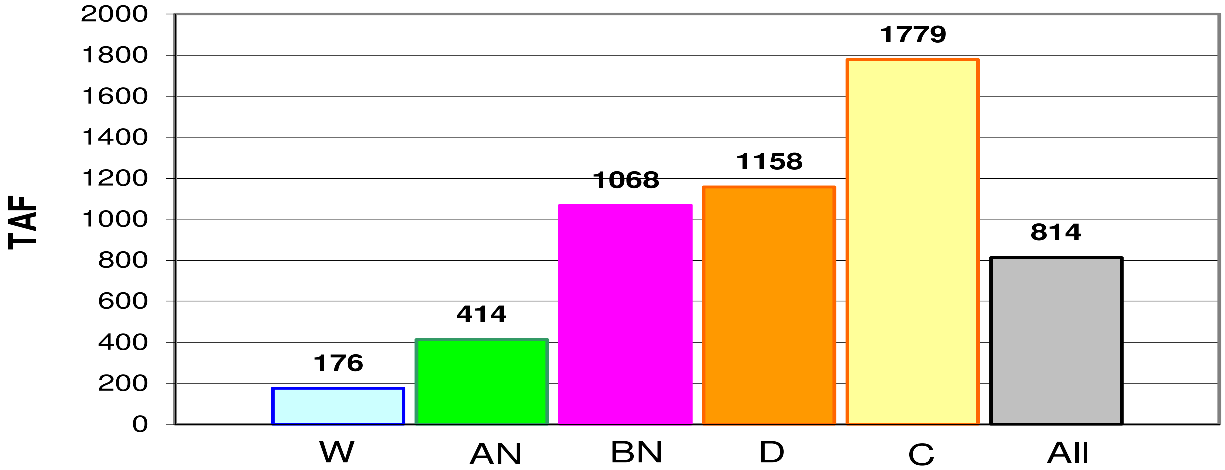


Figure 22 - Monthly Change in Groundwater Pumping in Sacramento Valley - SWRCB DFC minus Existing (BO's)



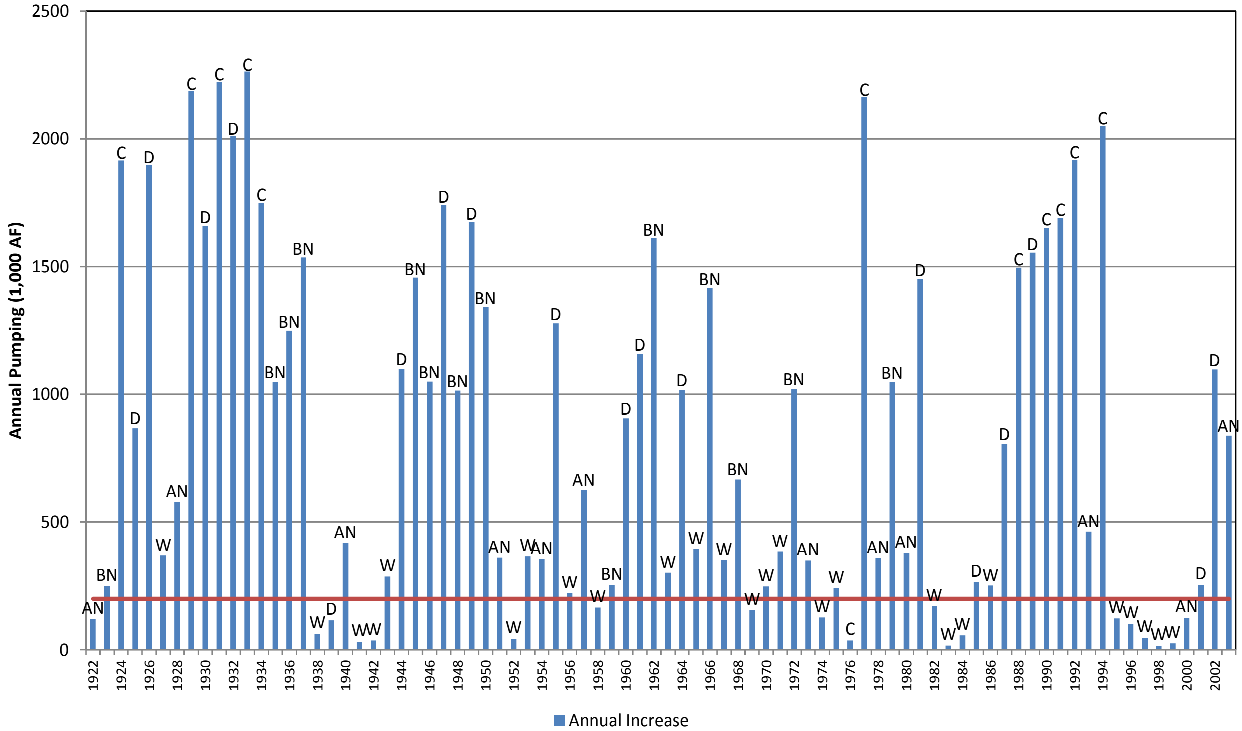
- Annual average existing (BO's) pumping according to CalSim II (very rough) = 2.385 MAF.
- Average annual pumping with SWRCB DFC = 3.198 MAF.
- Average annual change in groundwater pumping is 814 TAF.

There are a large number of factors affecting the interrelationship between groundwater levels and pumping, stream-groundwater interaction, deep percolation of applied water, percolation of precipitation, and natural recharge; making it difficult to speculate how much additional pumping, recharge, and fallowing would occur. Therefore, determining the appropriate equilibrium of these factors is difficult, if not impossible, under existing conditions, and is even more difficult under the SWRCB DFC.

Groundwater pumping is increased during dry and critical years, and is believed that increases in pumping could not be sustained. In the past during dry and critical years there have been groundwater substitution water transfers. A reasonable assumption is that some level of increased pumping may occur under SWRCB DFC conditions. For the purpose of this analysis, and due to the historical transfers and the proposed SWRCB Bay-Delta Hearing Phase 8 Settlement, it may be reasonable to assume that up to 200,000 AF of increased pumping may occur.

Annual limit of increased groundwater pumping is 200,000 AF indicated by the red line on the chart below. The amount of increased pumping used in the hydropower analysis is the minimum of 200,000 AF or the annual increase displayed **(Figure 23)**.

Figure 23 - Annual Change in Groundwater Pumping in Sacramento Valley - SWRCB DFC minus Existing (BO's)



Shasta storage would het dead pool in close to 60 percent of all years. Even in years when storage is above minimum it would be impossible to satisfy upper Sacramento River temperature objectives in almost every year. It may be possible to meet temperature objectives in less than 10 percent of years; however reductions in Keswick release from June through November will cause increased warming making it more difficult to meet objectives **(Figure 23).**

Figure 24 - End of September Shasta Storage

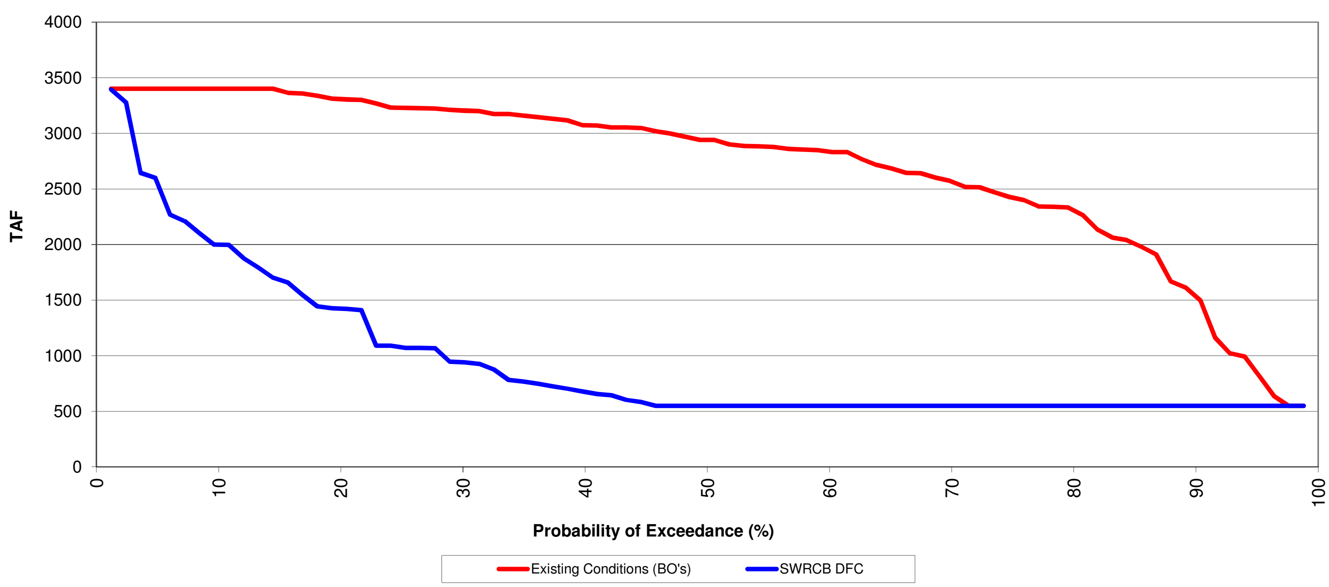


Figure 25 - Change in Keswick Release - SWRCB DFC minus Existing (BO's)

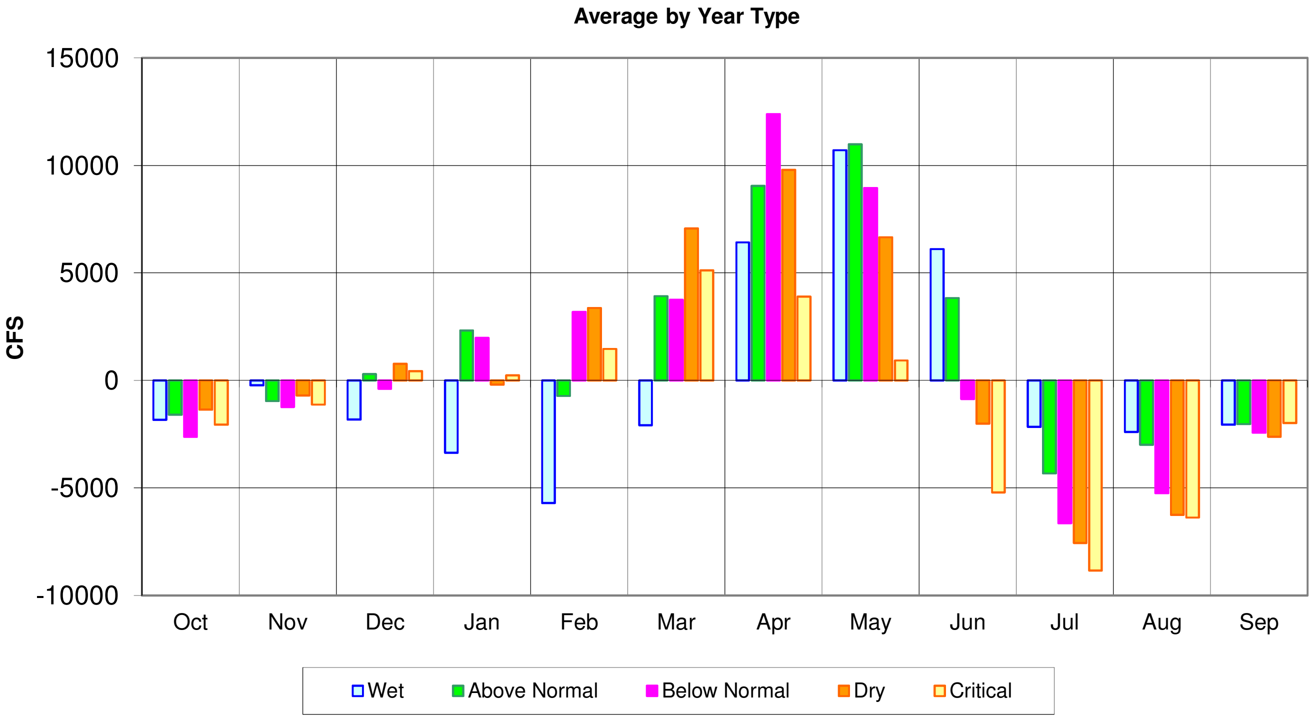


Figure 26 - Monthly Shasta Storage for Existing (BO's) and SWRCB DFC

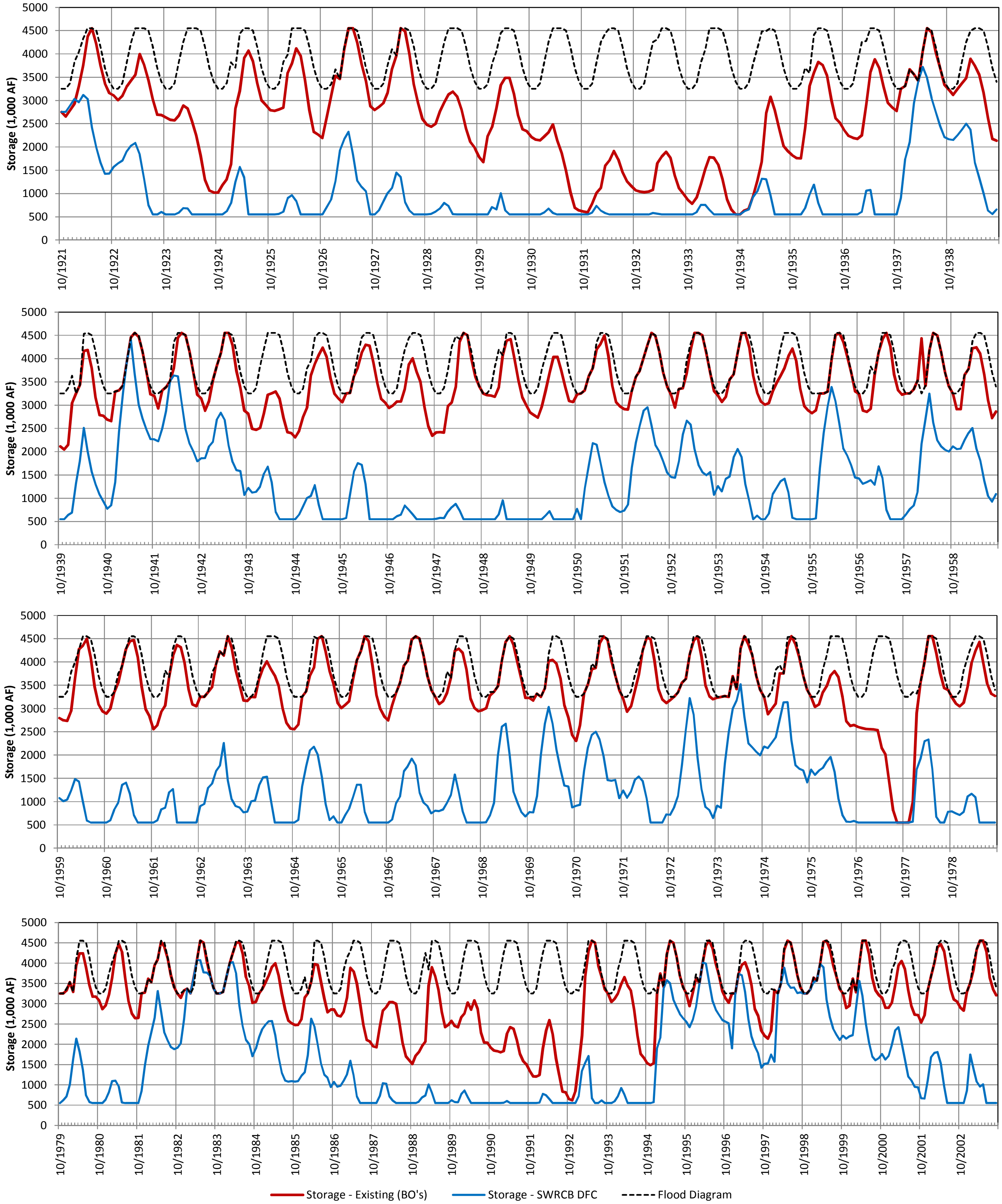
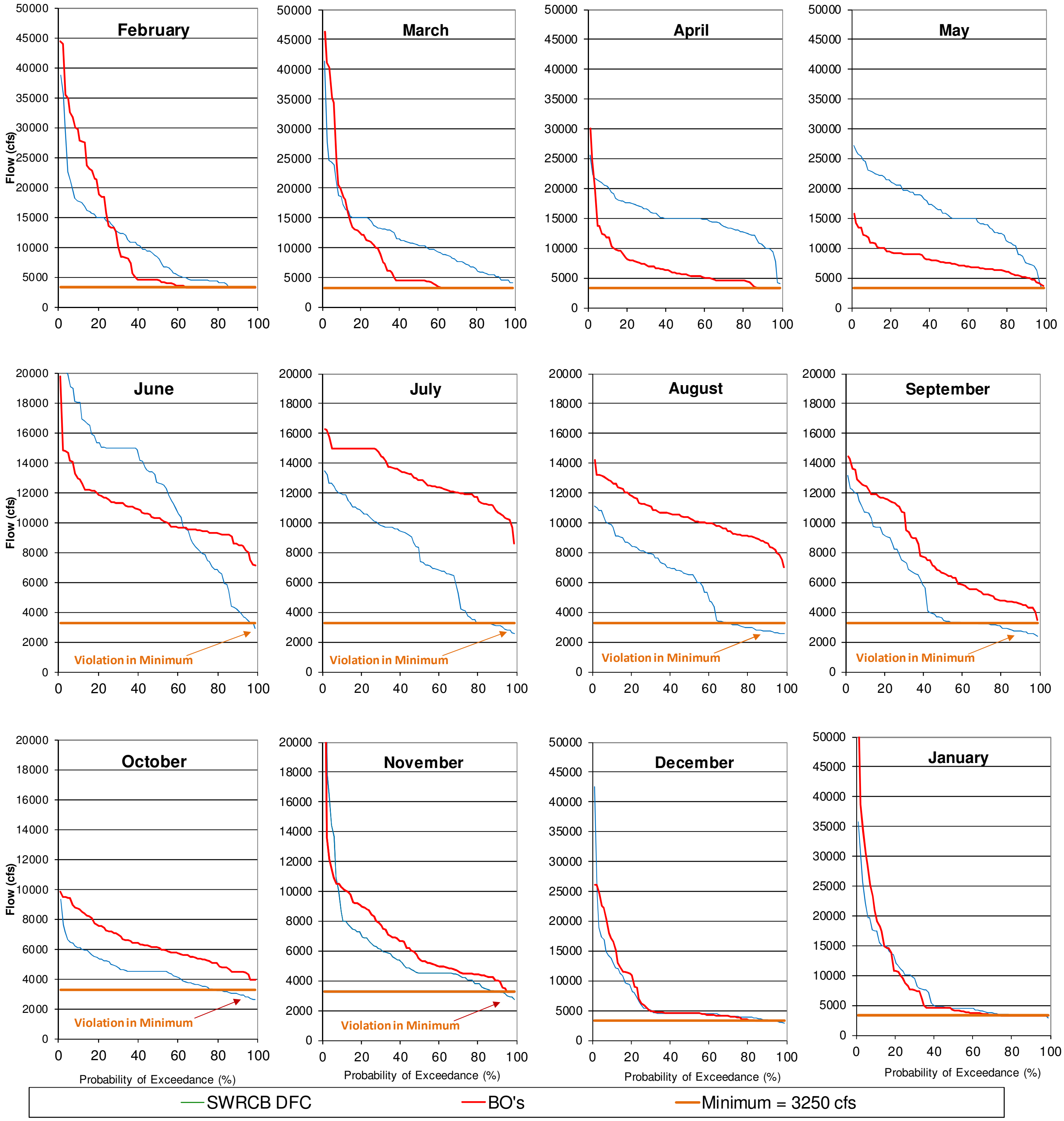
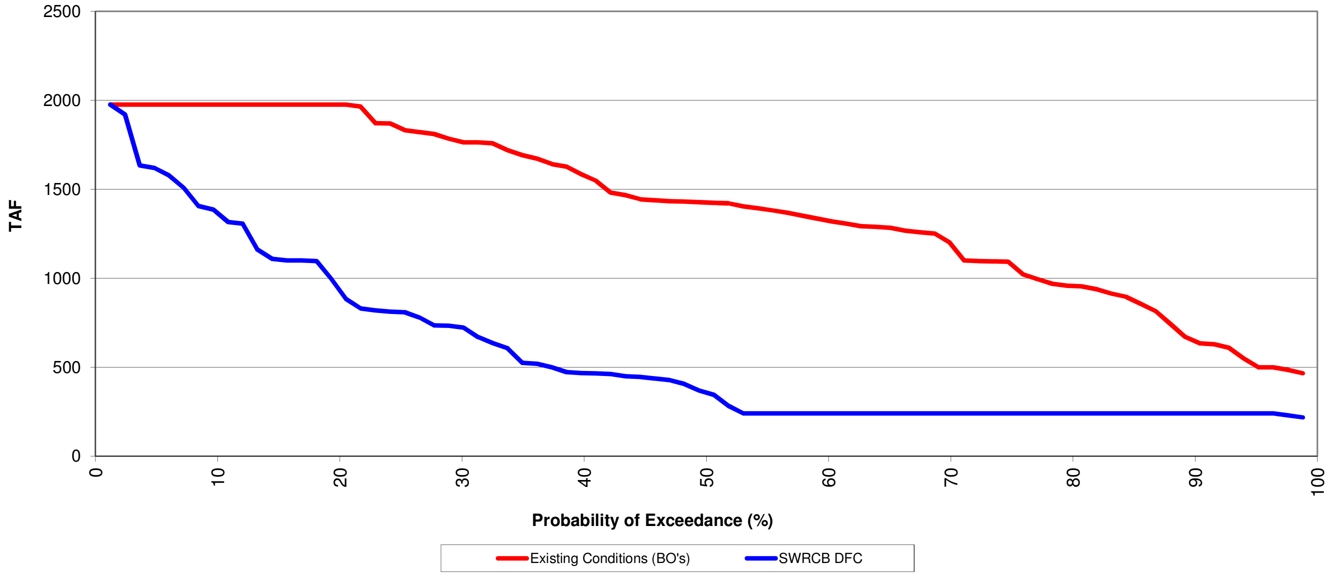


Figure 27 - Average Monthly Sacramento River Flow Below Keswick for Existing (BO's) and SWRCB DFC



There are often violation in the minimum flow requirement below Keswick, when this occurs both Shasta and Trinity Reservoirs are at dead storage (**Figure 28**).

Figure 28 - End of September Trinity Storage



The SWRCB DFC are very extreme and CalSim II was not designed to address these circumstances, therefore the logic that balances Trinity and Shasta Reservoir storage properly for existing (BO's) conditions may not be suitable when operating to satisfy the SWRCB flow criteria. Logic may need to be developed that isolates the Trinity operation from the Sacramento River Basin. Because Trinity River imports are increased in the SWRCB DFC model simulation there is likely an underestimate of hydropower impacts (**Figure 29**).

Figure 29 - Monthly Change in Trinity River Import - SWRCB DFC minus Existing (BO's)

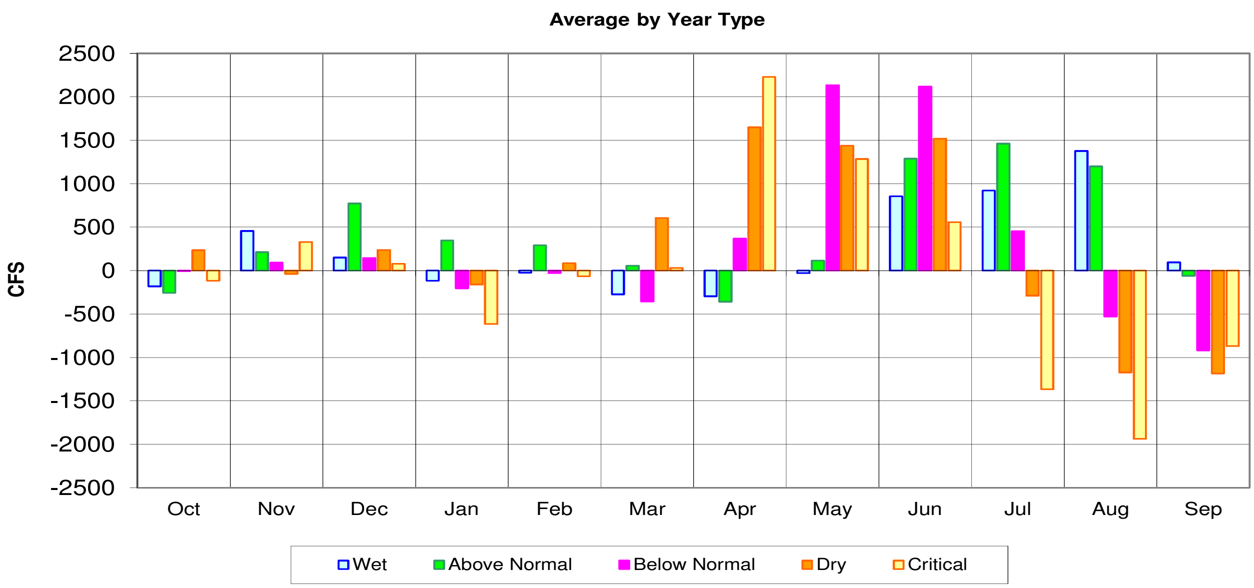


Figure 30 - Annual Change in Trinity River Import - SWRCB DFC minus Existing (BO's)

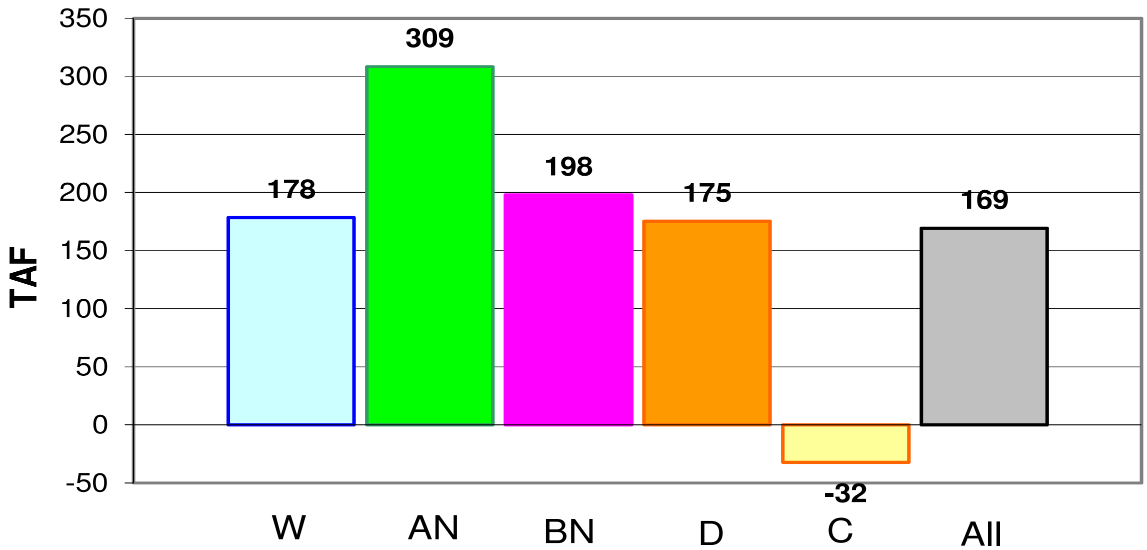
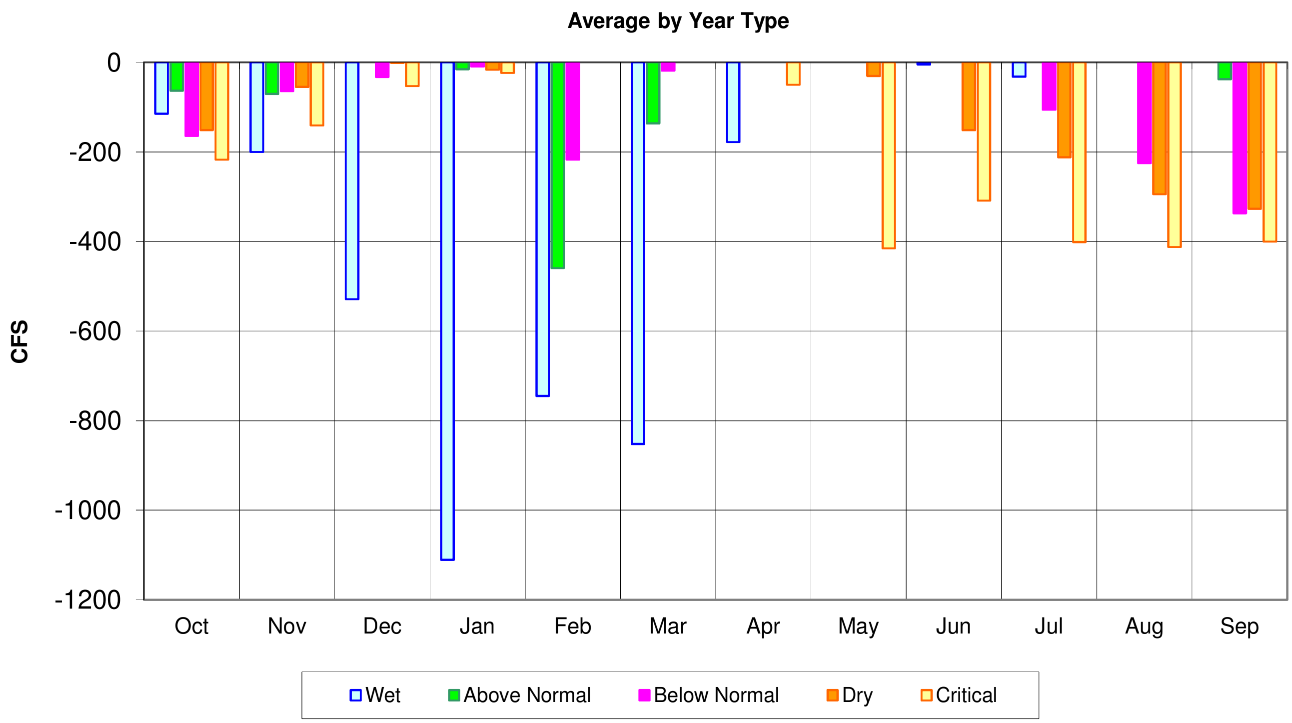


Figure 31 - Monthly Change in Trinity River Flow - SWRCB DFC minus Existing (BO's)



There is an average annual decrease of 129 TAF release to the Trinity River, this differs from the increase Trinity River import of 169 TAF because the end of simulation storage in Trinity is 1.5 MAF lower (**Figure 32**).

Figure 32 - Annual Change in Trinity River Flow - SWRCB DFC minus Existing (BO's)

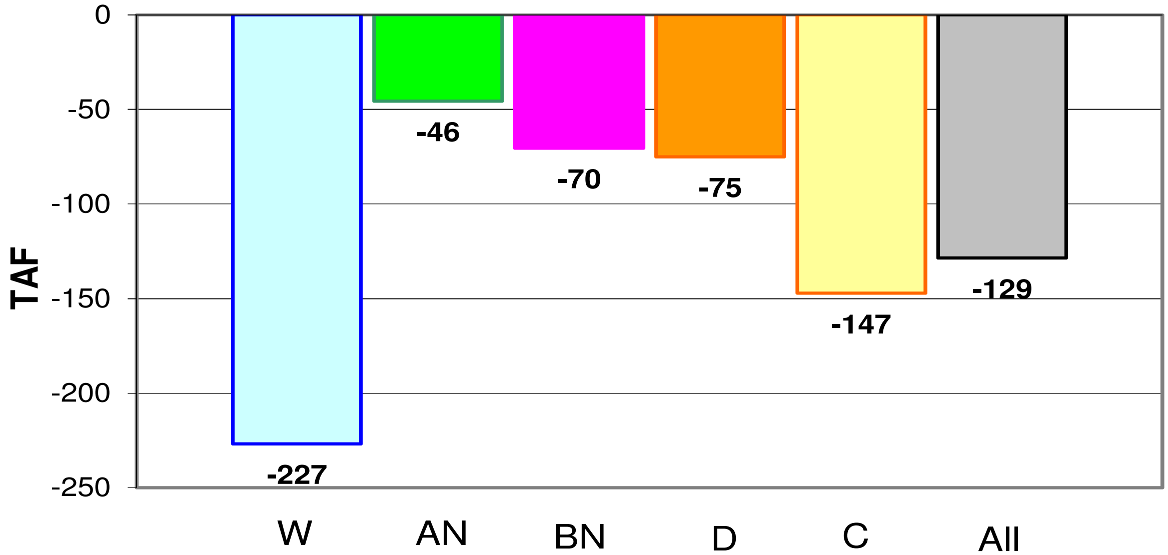
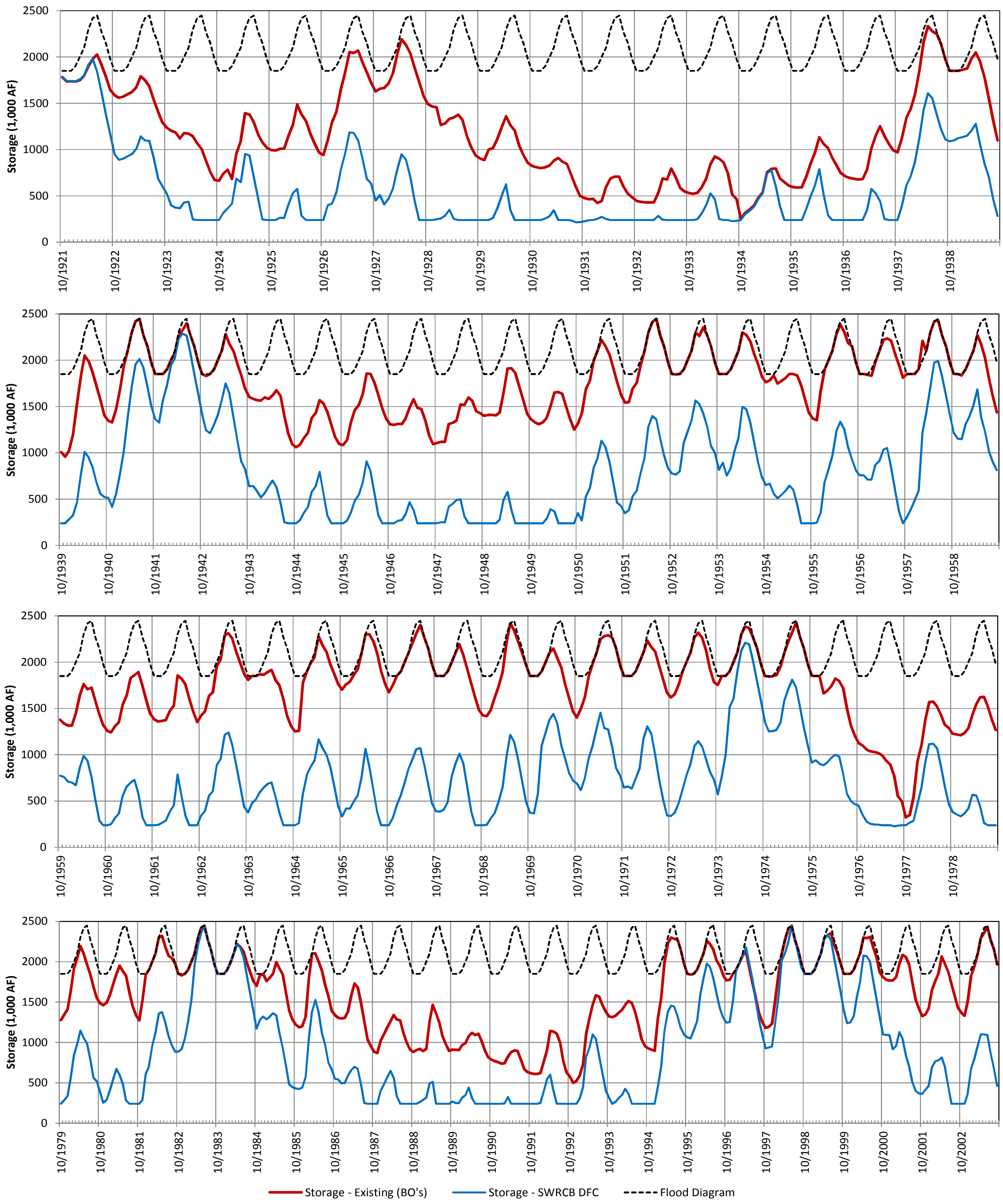


Figure 33 - Monthly Trinity Storage for Existing (BO's) and SWRCB DFC



Roughly 50 percent of the time Folsom would end the water year at dead storage (**Figure 34**).

Figure 34 - End of September Folsom Storage

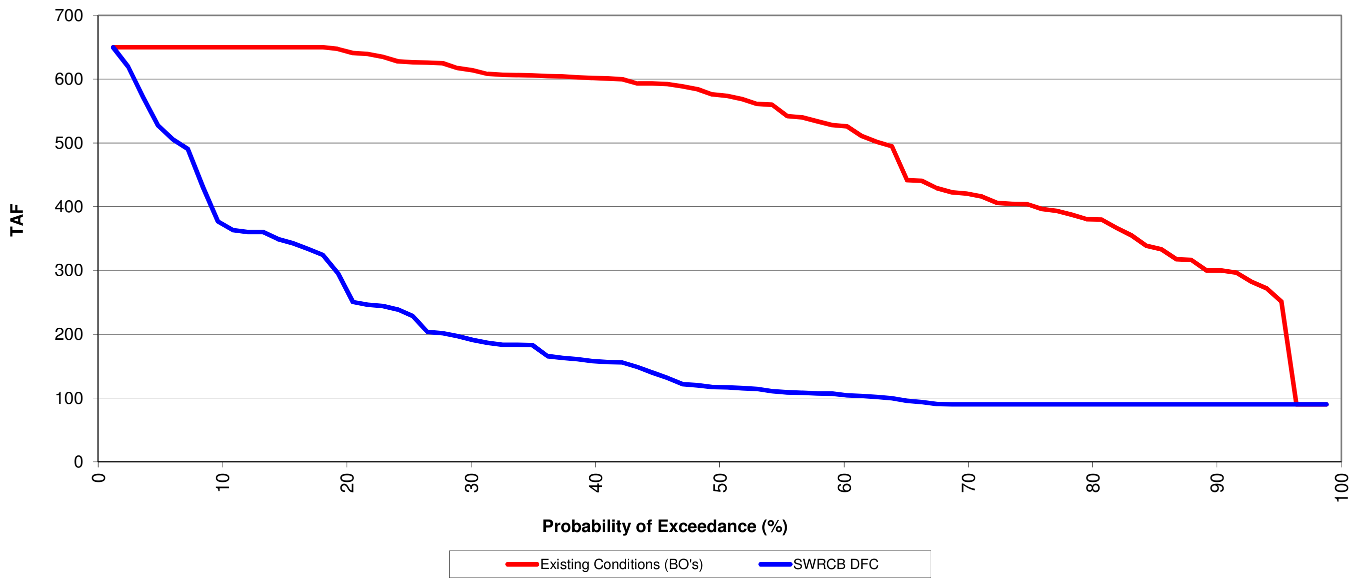


Figure 35 - Change in American River Flow below Nimbus - SWRCB DFC minus Existing (BO's)

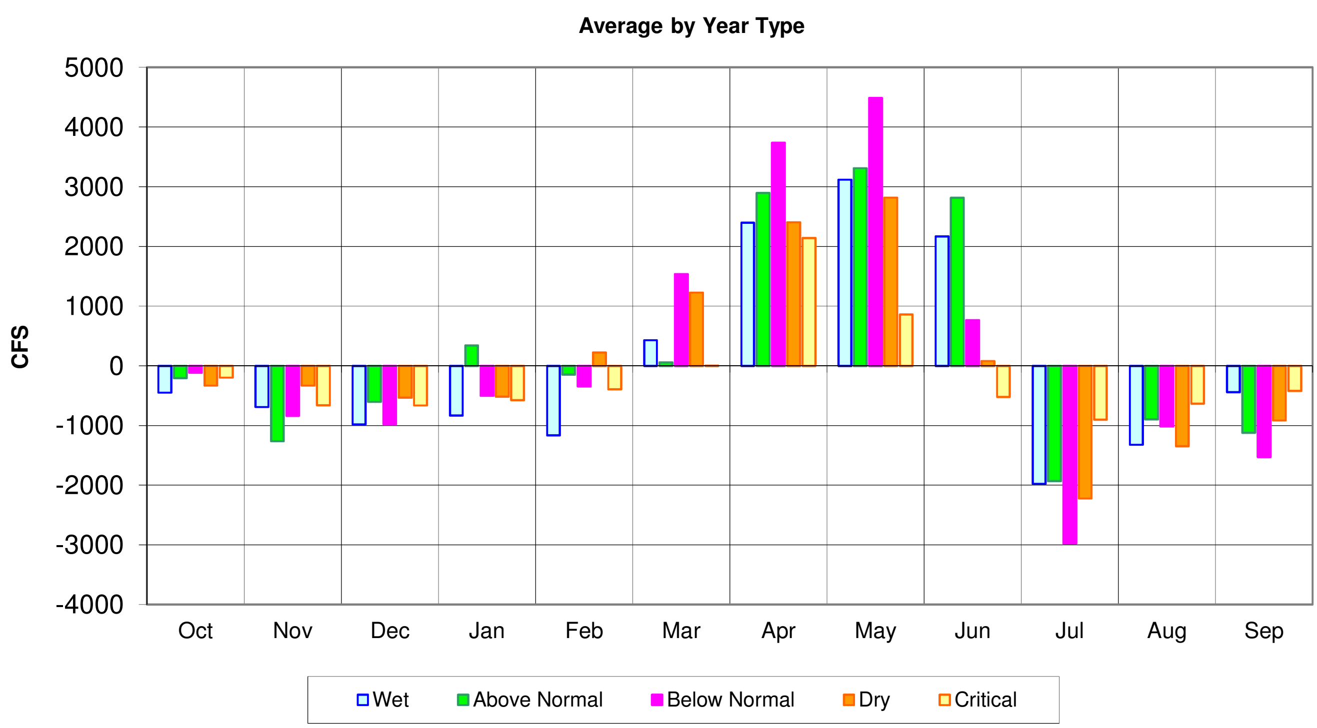


Figure 36 - Monthly Folsom Storage for Existing (BO's) and SWRCB DFC

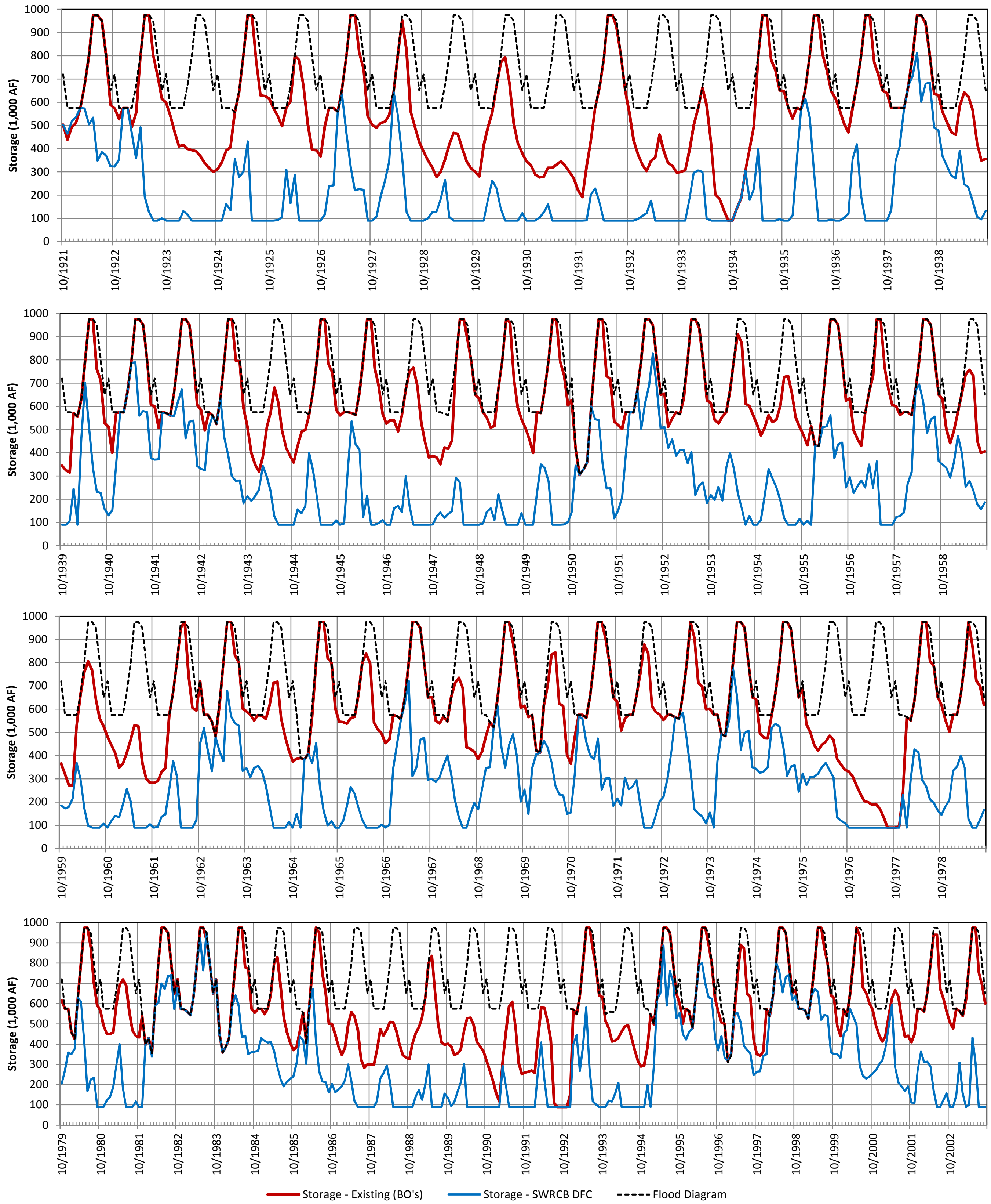


Figure 37 - Average Monthly American River Flow below Nimbus for Existing (BO's) and SWRCB DFC

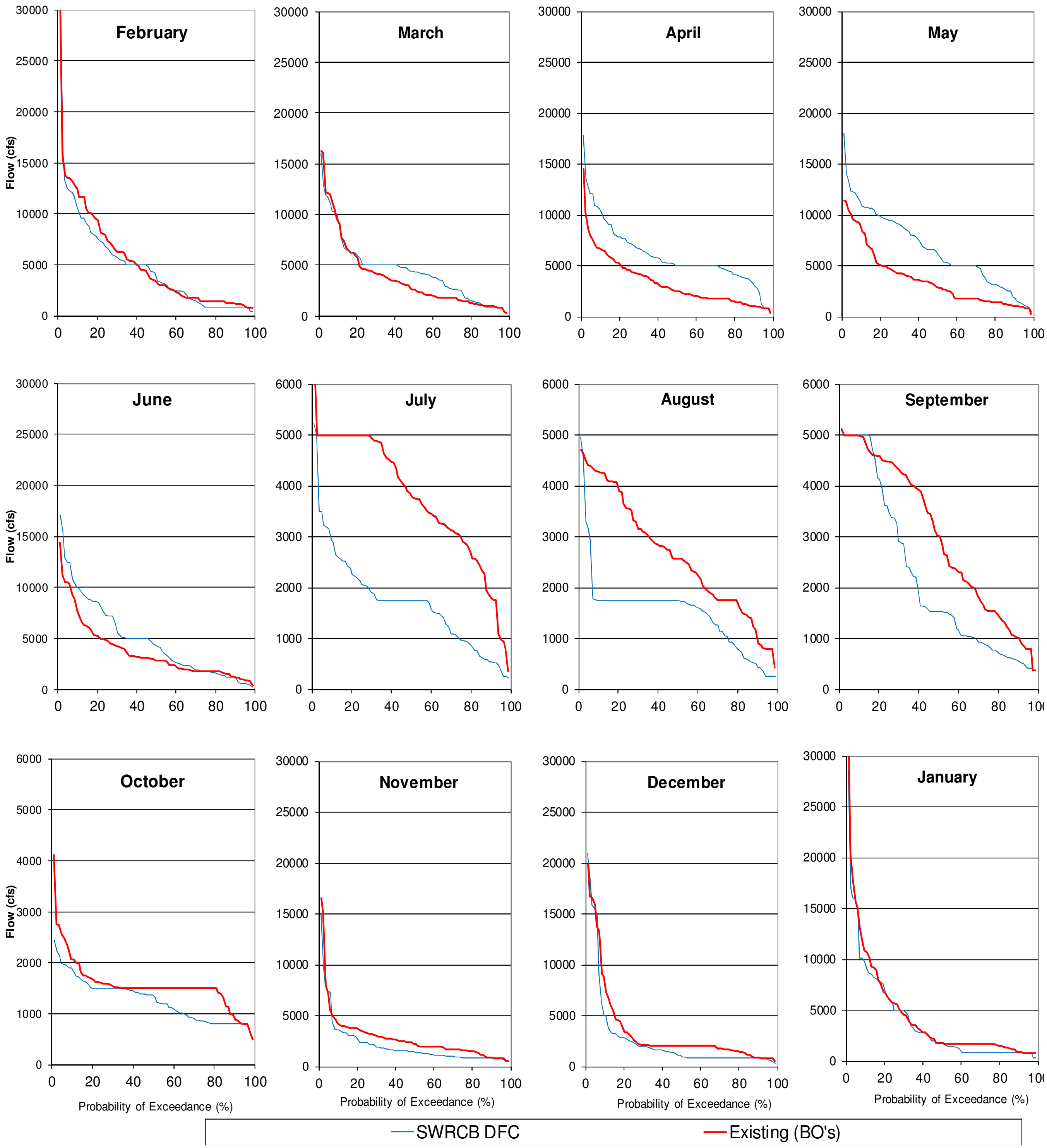


Figure 38 - End of September Oroville storage

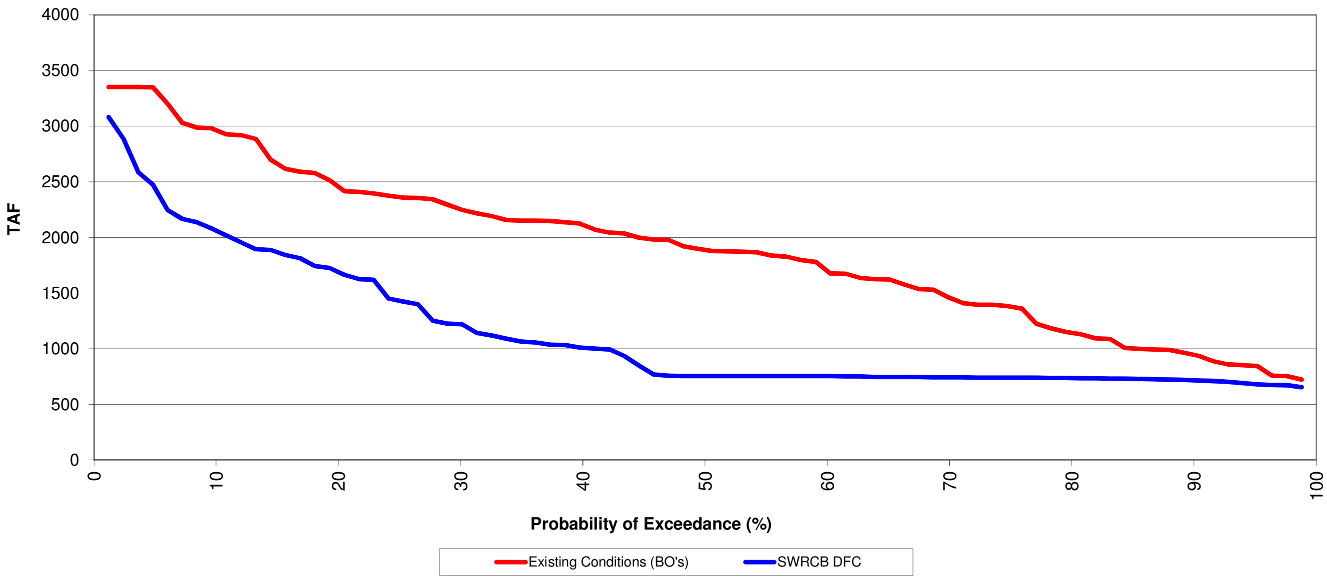


Figure 39 - Change in Feather River Flow below Thermalito - SWRCB DFC minus Existing (BO's)

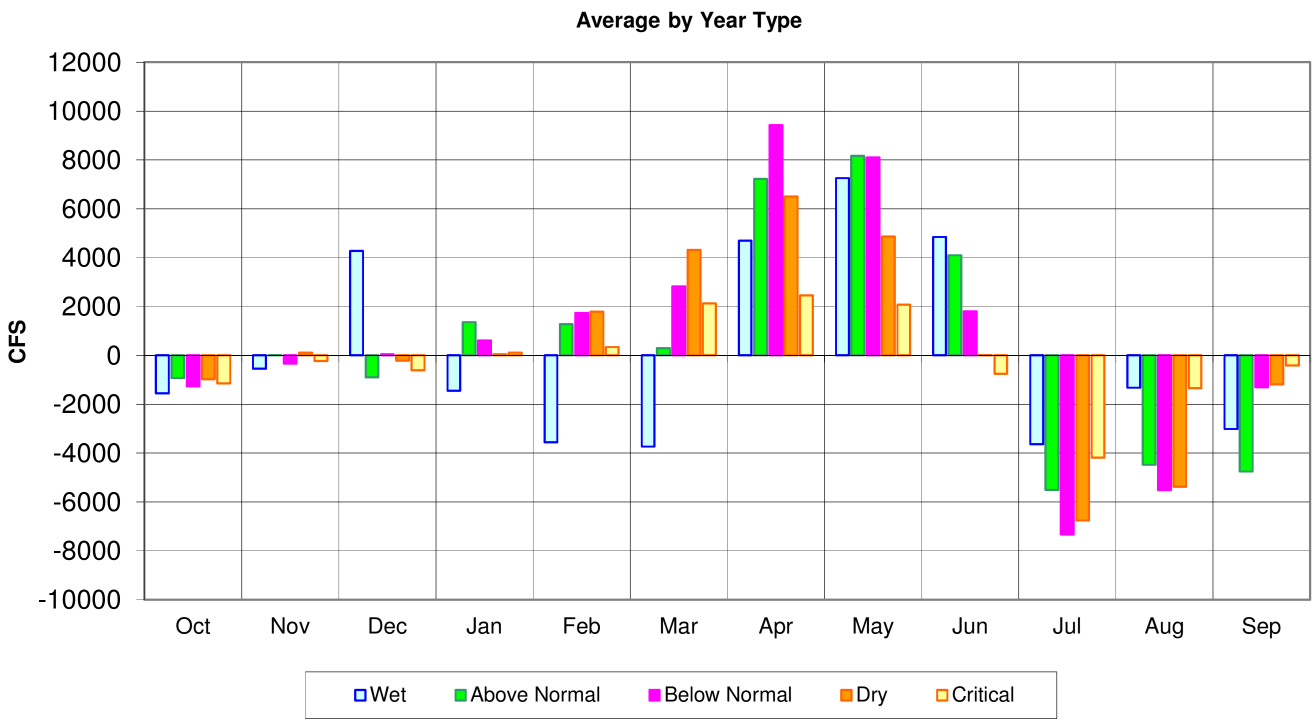


Figure 40 - Monthly Oroville Storage for Existing (BO's) and SWRCB DFC

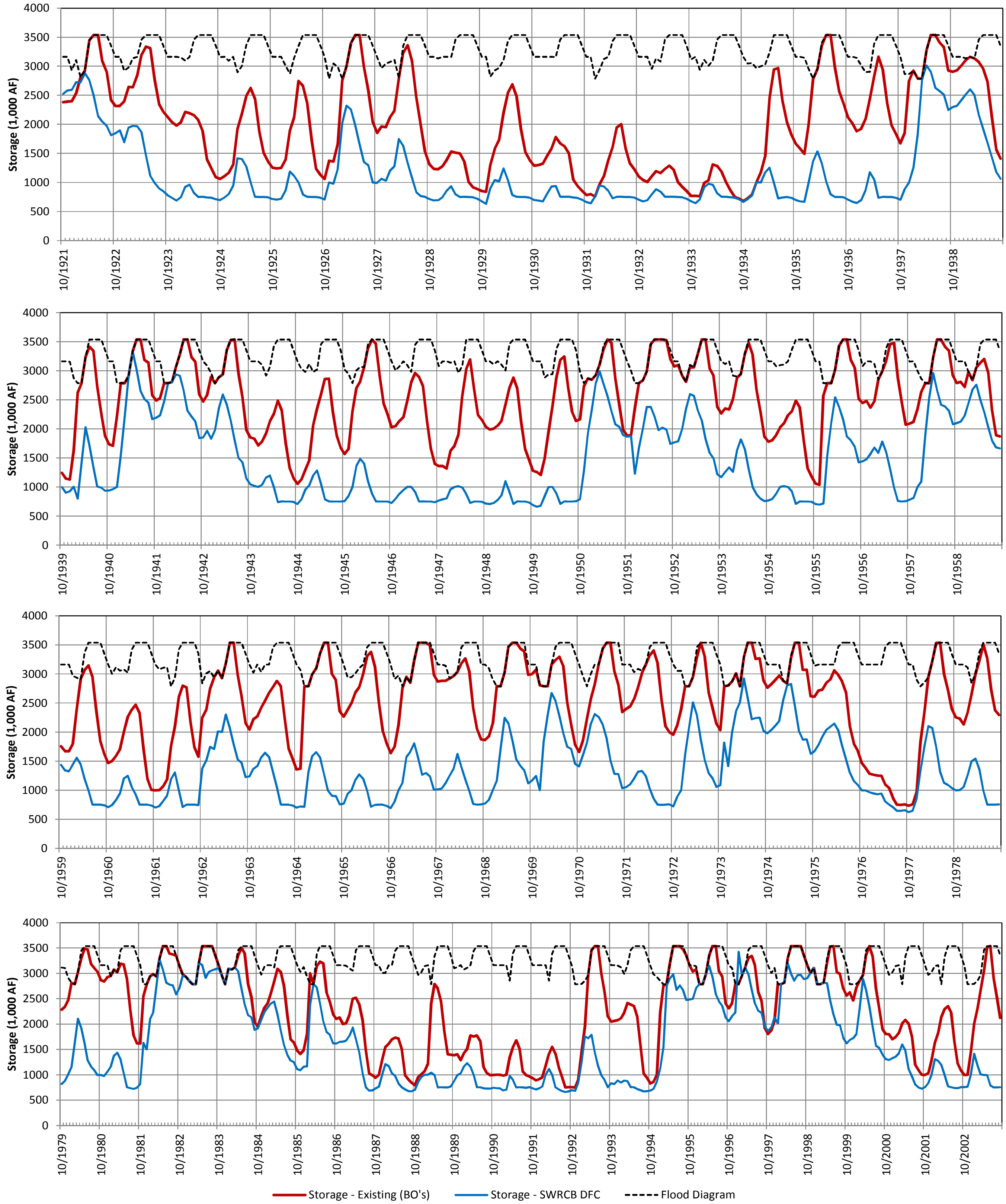


Figure 41 - Average Feather River Flow below Thermalito for Existing (BO's) and SWRCB DFC

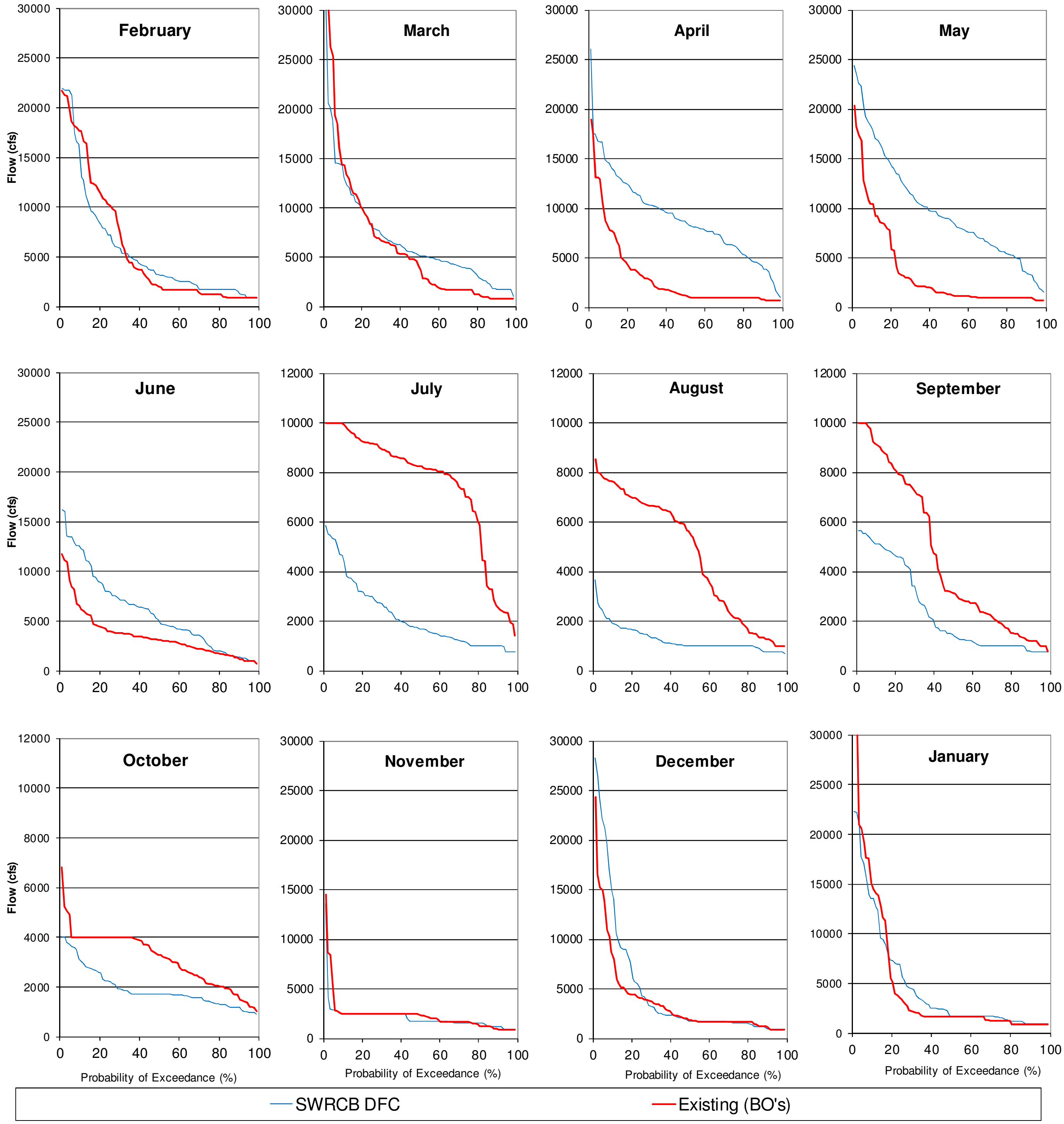


Figure 42 - Change in San Joaquin River at Vernalis - SWRCB DFC minus Existing (BO's)

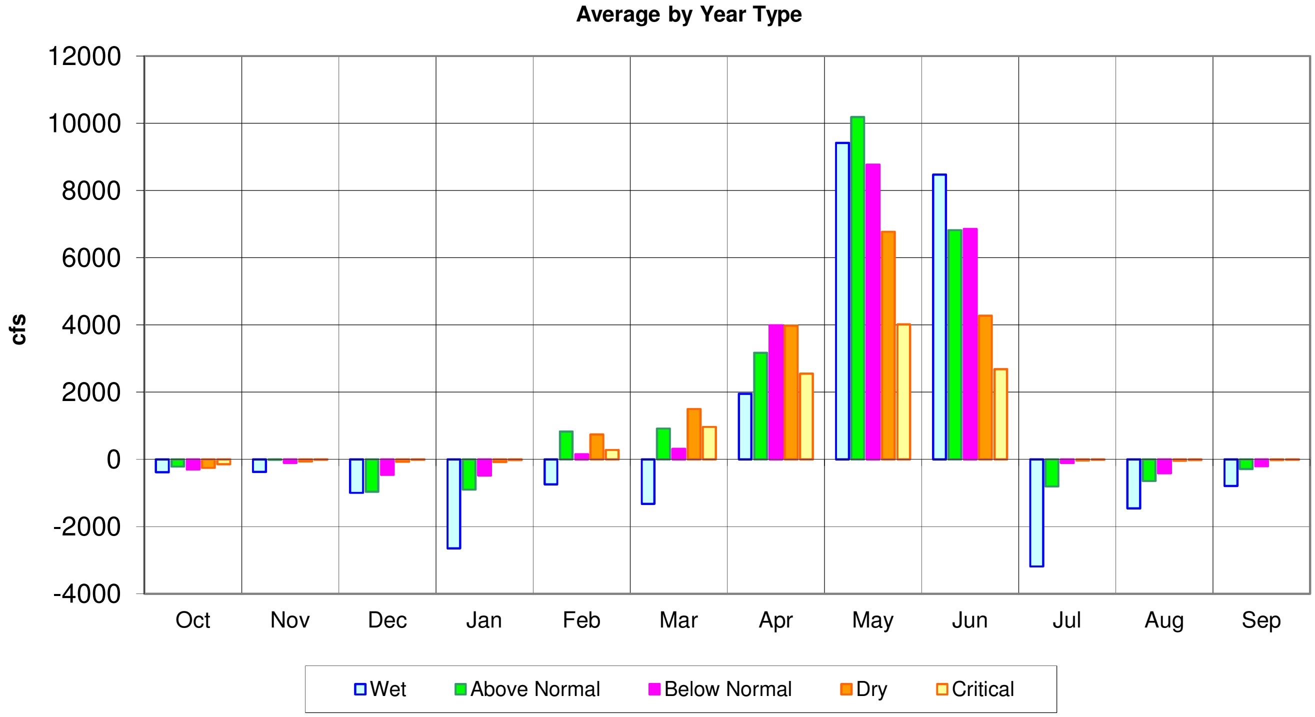


Figure 43 - Annual Change in San Joaquin River at Vernalis - SWRCB DFC minus Existing (BO's)

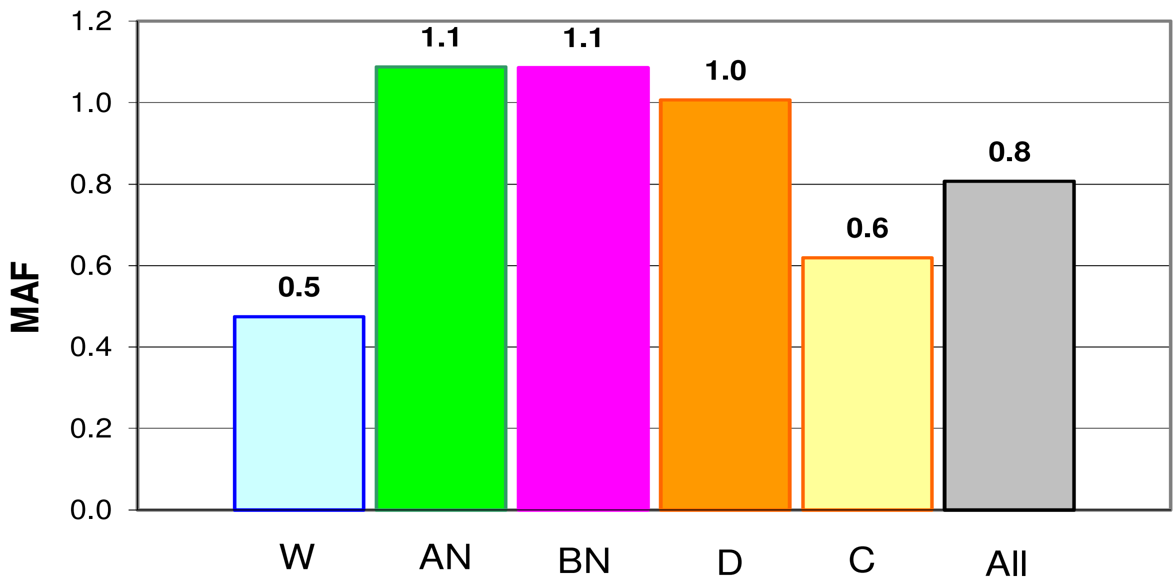


Figure 44 - Monthly San Joaquin River Flow at Vernalis for Existing (BO's) and SWRCB DFC

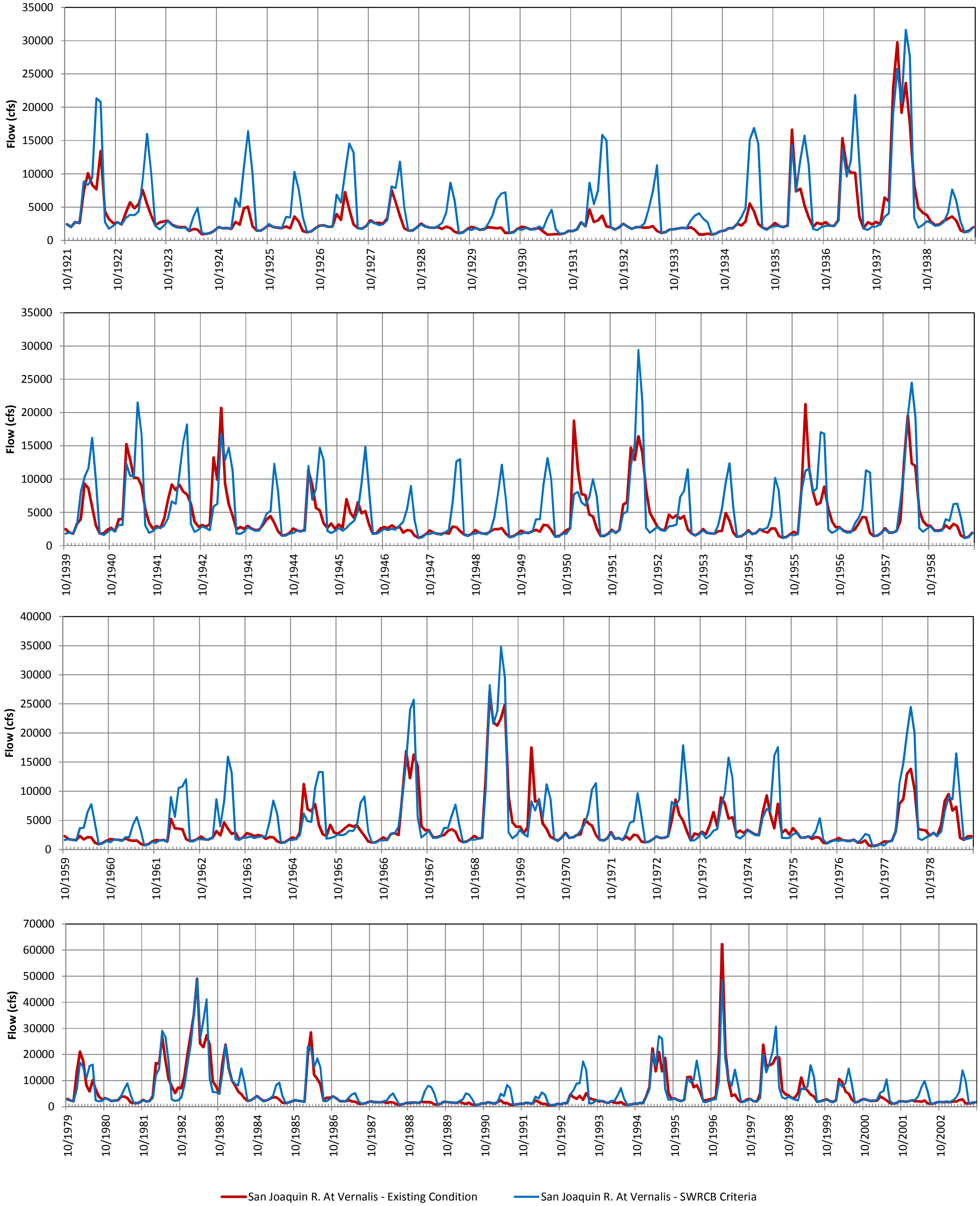


Figure 45 is shown with the SWRCB DFC San Luis Reservoir fills in one year (1983).

Figure 45 - San Luis Reservoir Annual Maximum Storage for Existing (BO's) and SWRCB DFC

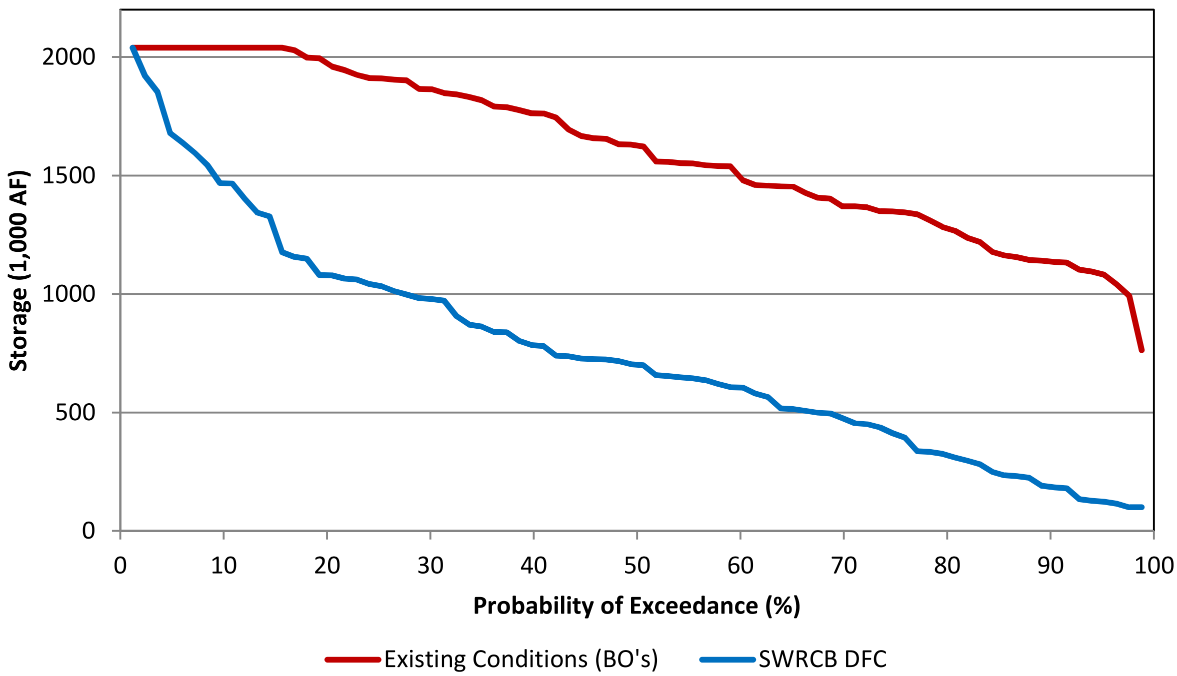


Figure 46 is shown with the SWRCB DFC San Luis reaches dead pool in all but 2 years (1983 and 1965) and remains at dead pool for several months in most years.

Figure 46 - San Luis Reservoir Annual Low Point in Storage for Existing (BO's) and SWRCB DFC

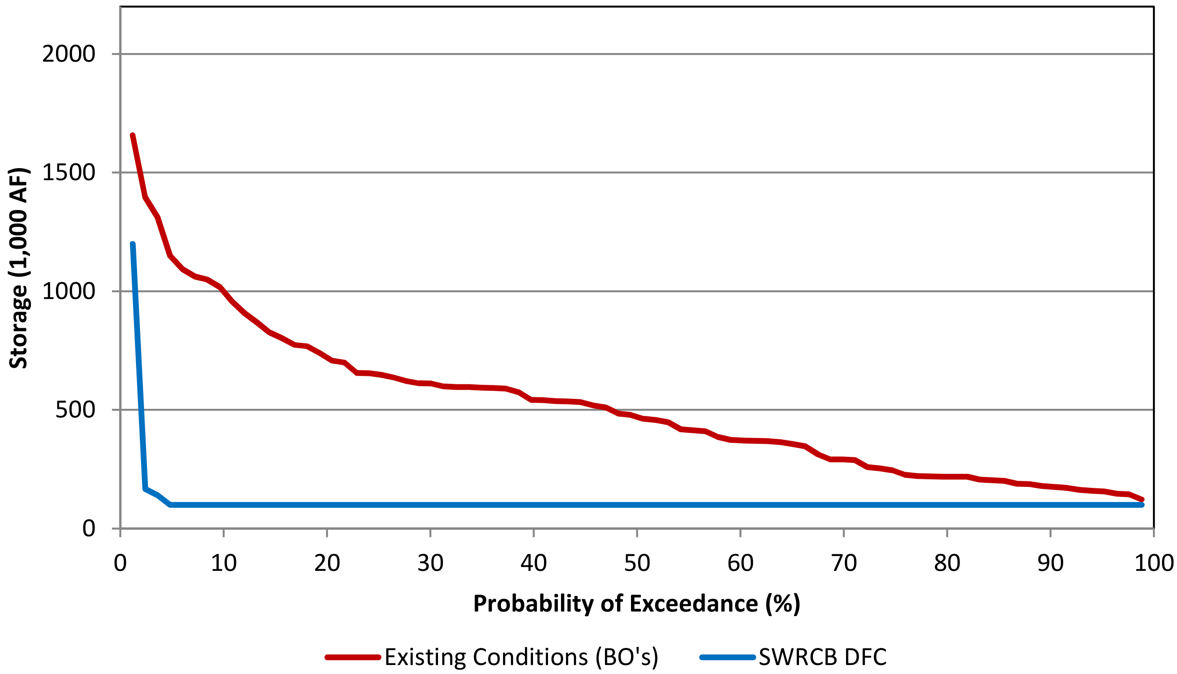
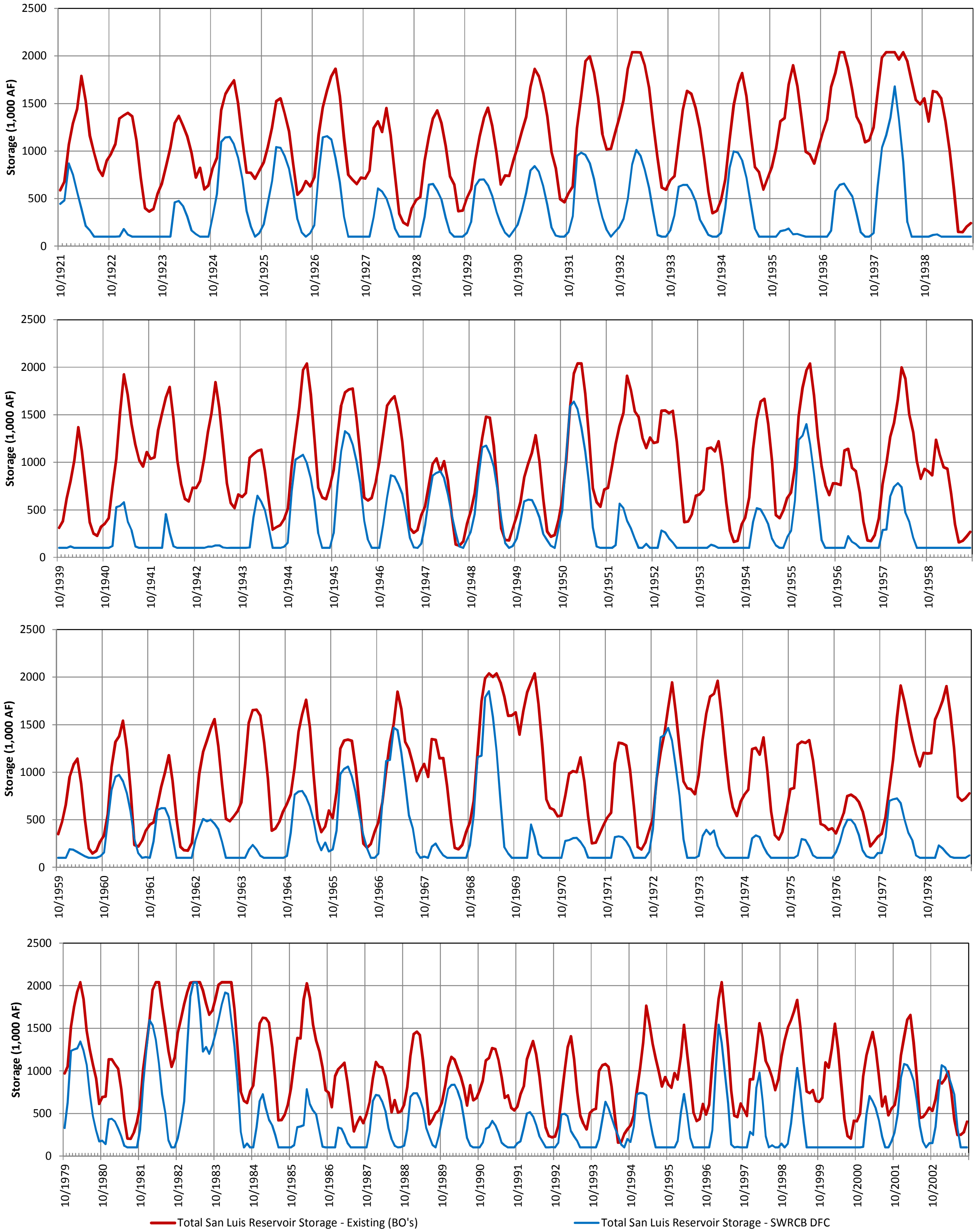
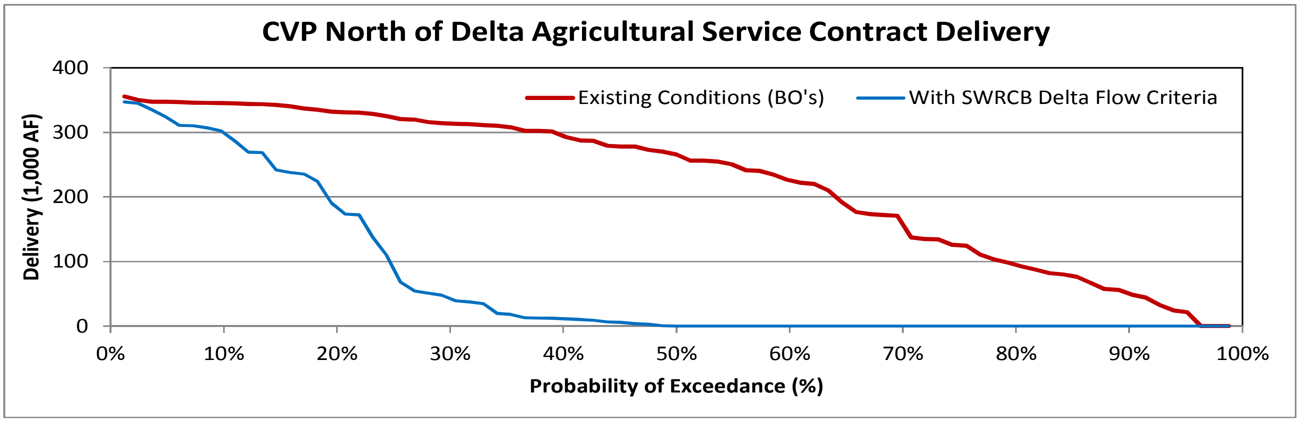
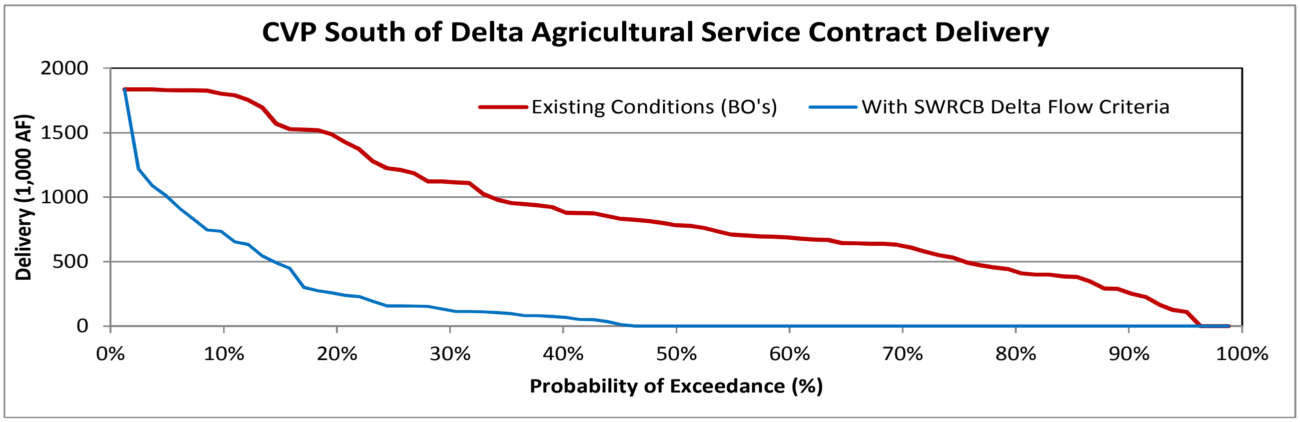
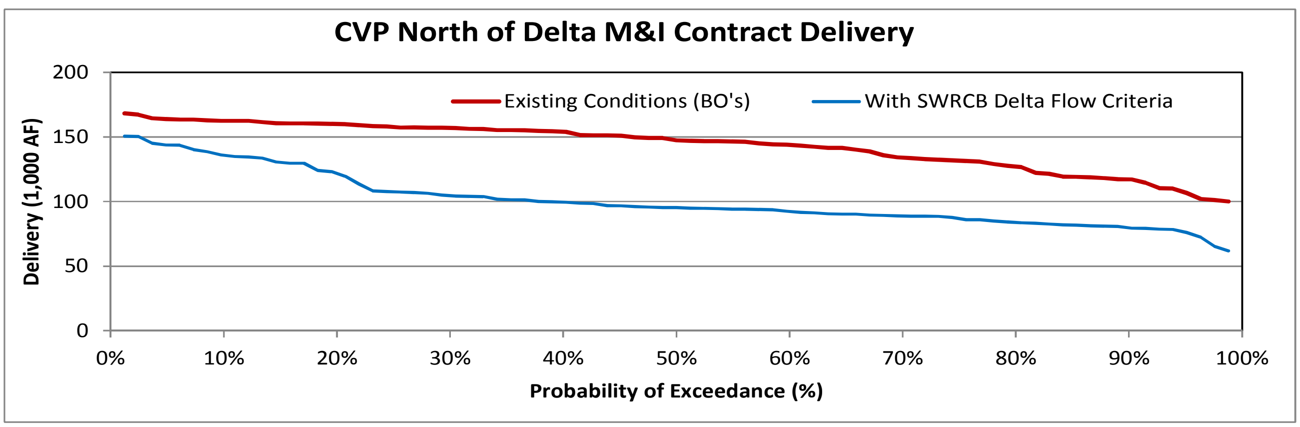


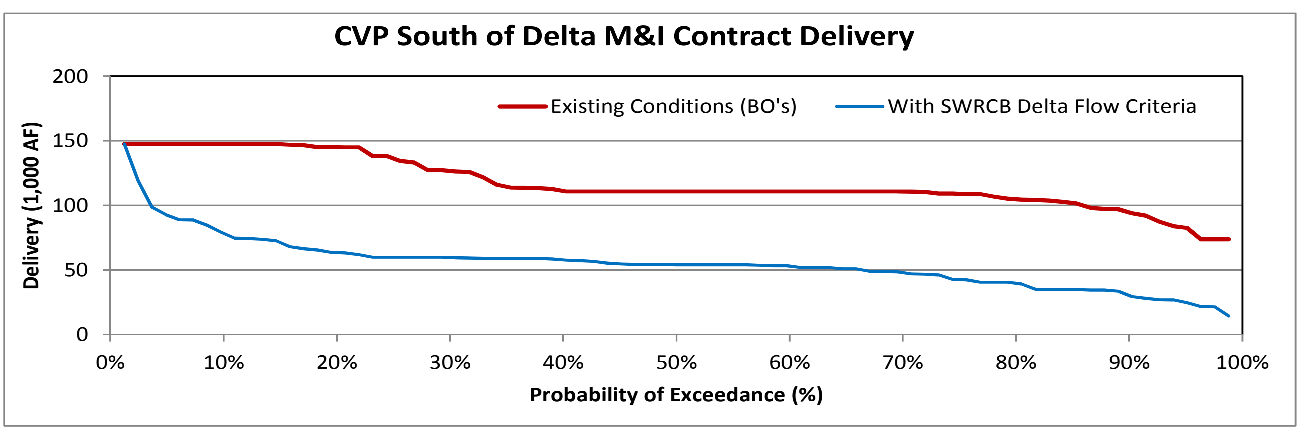
Figure 47 - Total San Luis Reservoir Storage for Existing (BO's) and SWRCB DFC

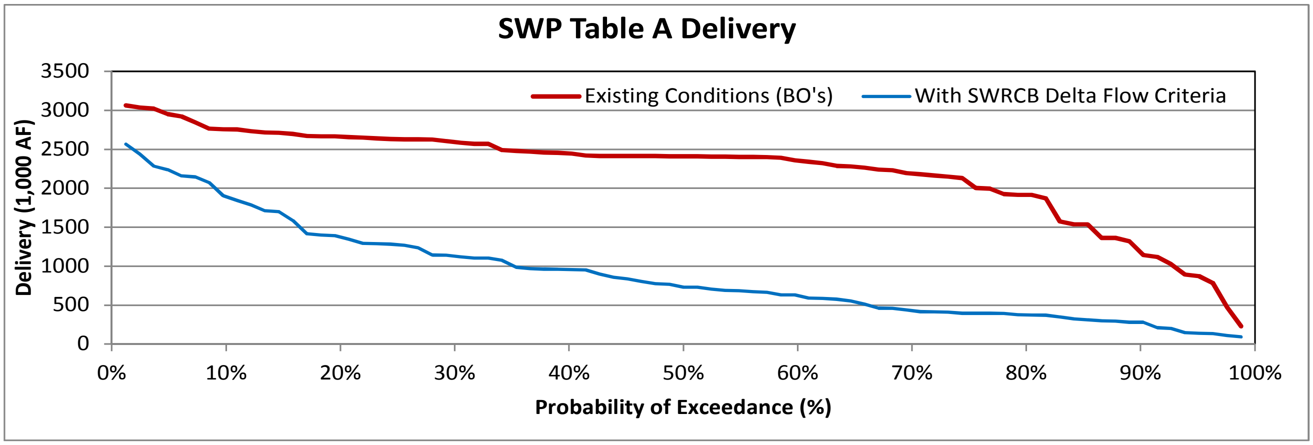


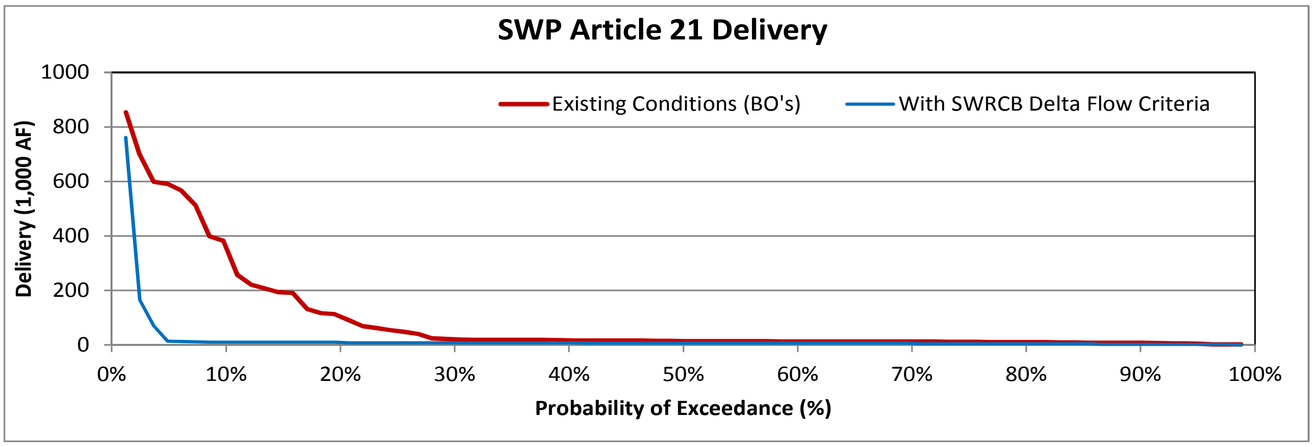

CVP North of Delta Agricultural Service Contract Delivery
Existing Conditions (BO's)
With SWRCB Delta Flow Criteria
Delivery (1,000 AF)
0
100
200
300
400
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance (%)

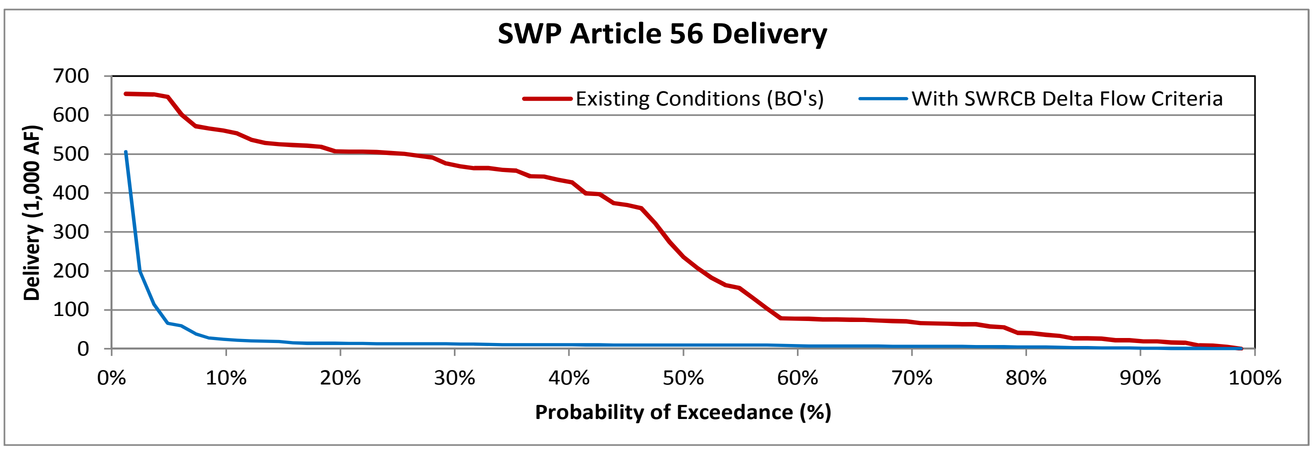

CVP South of Delta Agricultural Service Contract Delivery
Existing Conditions (BO's)
With SWRCB Delta Flow Criteria
Delivery (1,000 AF)
0
500
1000
1500
2000
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance (%)


CVP North of Delta M&I Contract Delivery
Existing Conditions (BO's)
With SWRCB Delta Flow Criteria
Delivery (1,000 AF)
0
50
100
150
200
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance (%)


CVP South of Delta M&I Contract Delivery
Existing Conditions (BO's)
With SWRCB Delta Flow Criteria
Delivery (1,000 AF)
0
50
100
150
200
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance (%)

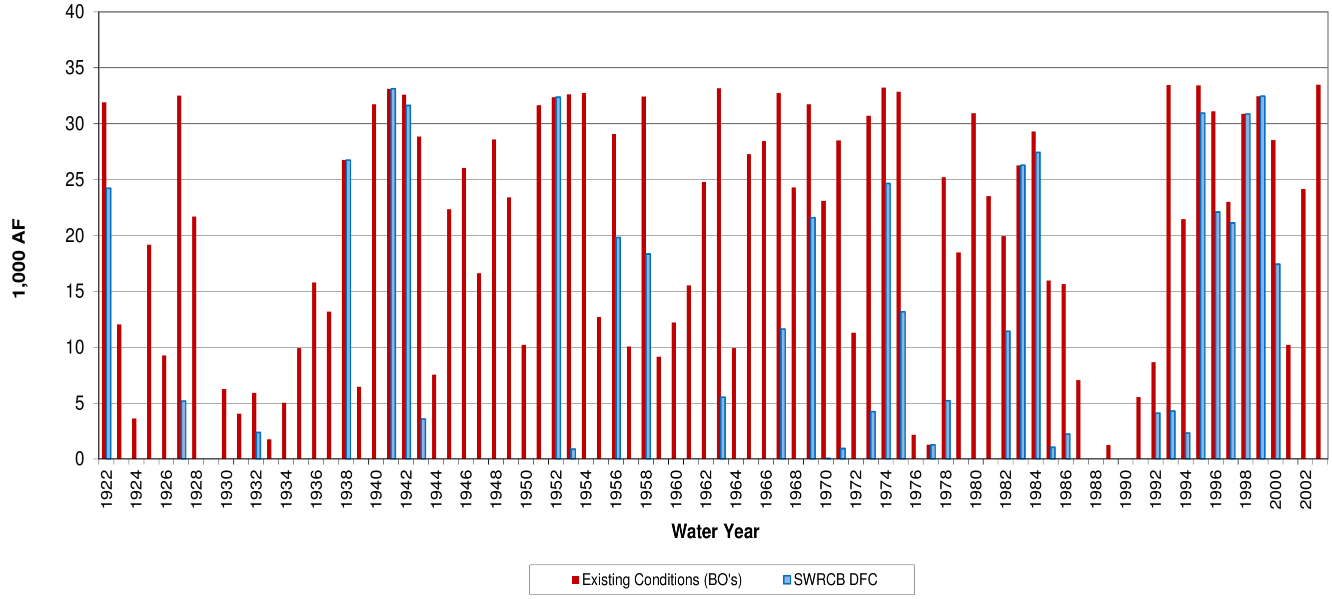

SWP Table A Delivery
Existing Conditions (BO's)
With SWRCB Delta Flow Criteria
Delivery (1,000 AF)
3500
3000
2500
2000
1500
1000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance (%)


SWP Article 21 Delivery
Existing Conditions (BO's)
With SWRCB Delta Flow Criteria
Delivery (1,000 AF)
1000
800
600
400
200
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance (%)


SWP Article 56 Delivery
Existing Conditions (BO's)
With SWRCB Delta Flow Criteria
Delivery (1,000 AF)
700
600
500
400
300
200
100
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance (%)

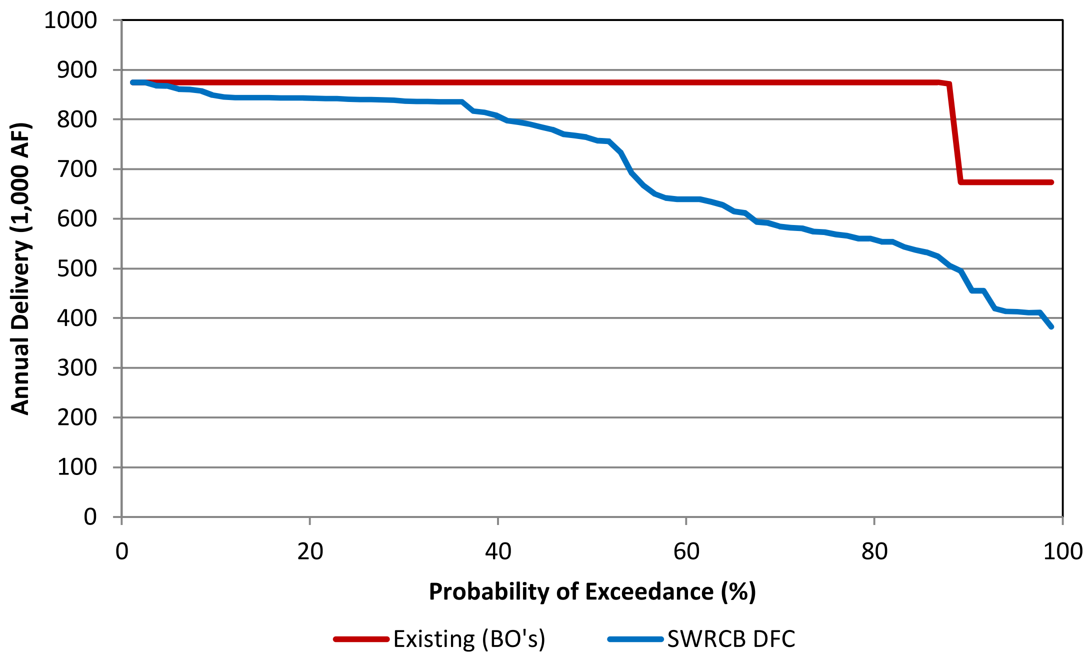
Delivery is not frequent enough to sustain surface water delivery system with SWRCB DFC (**Figure 48**).

Figure 48 - CVP North of Delta Ag Service Contract Delivery for Existing (BO's) and SWRCB DFC



Decrease in CVP Exchange Contract delivery requires releases from Friant to satisfy contract terms (**Figure 49**).

Figure 49 - CVP South of Delta Exchange Contract Delivery for Existing (BO's) and SWRCB DFC



Delivery is shorted when Shasta and Trinity Reservoirs reach dead pool and instream requirements can not be satisfied (**Figure 50**).

Figure 50 - CVP Sacramento Valley Settlement Contract Delivery for Existing (BO's) and SWRCB DFC

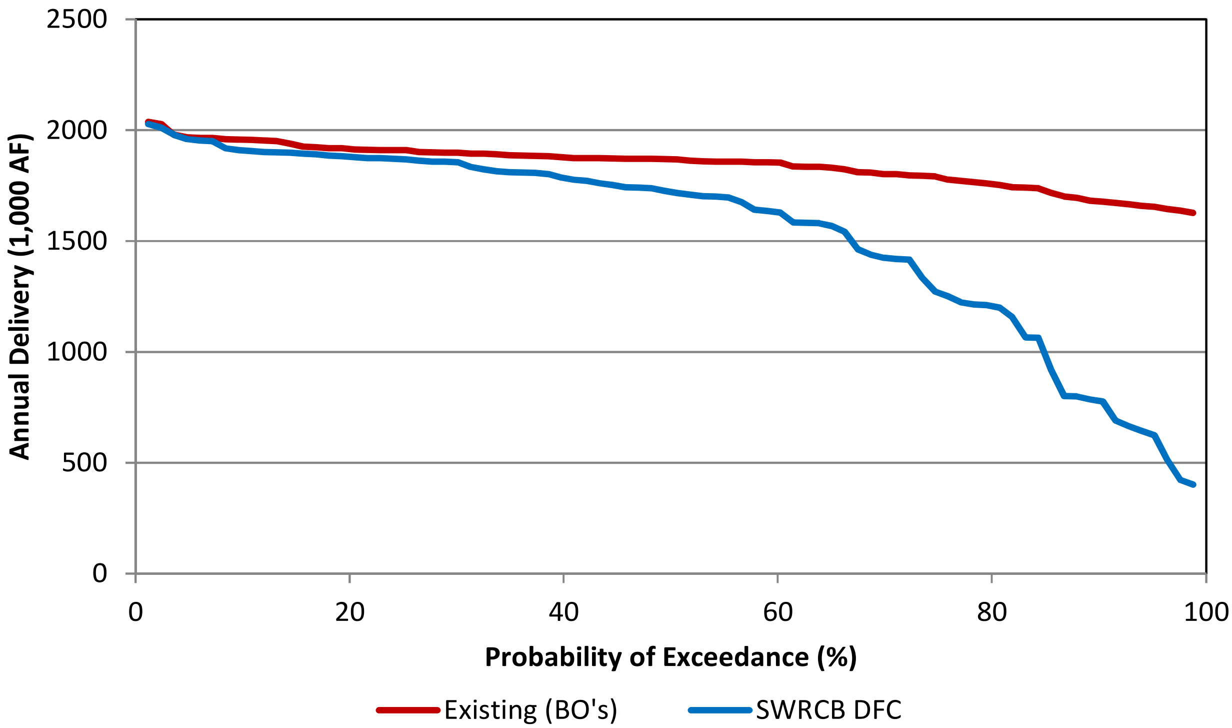
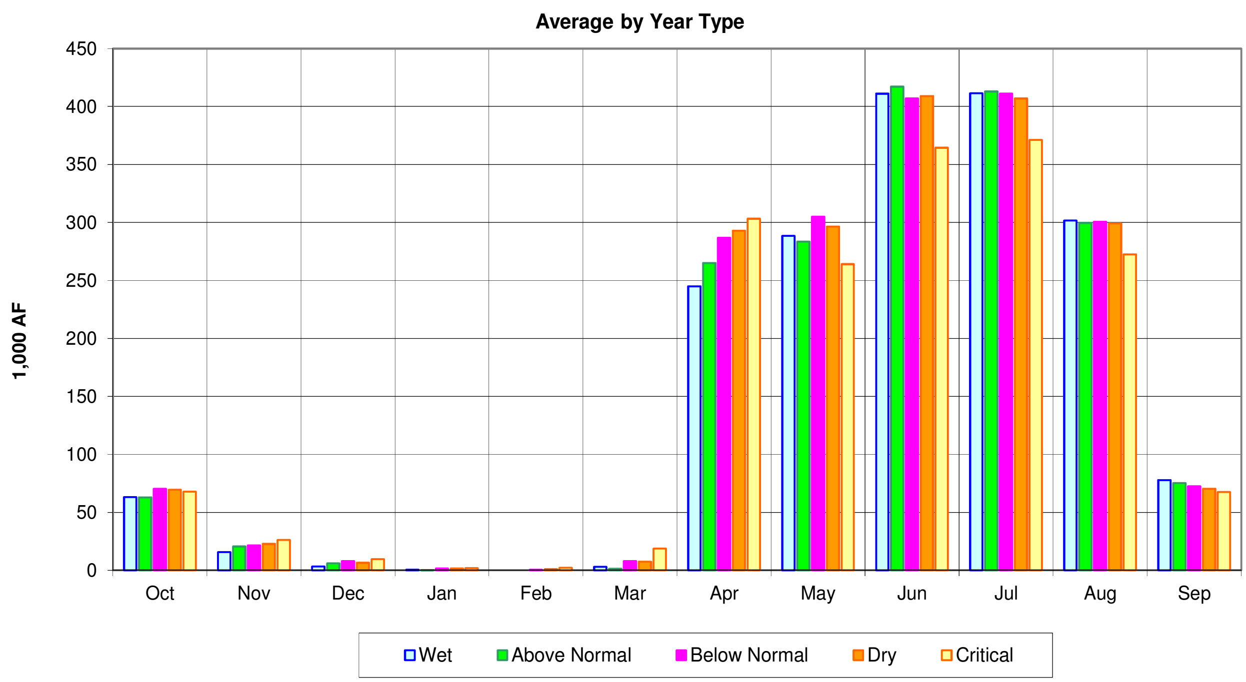
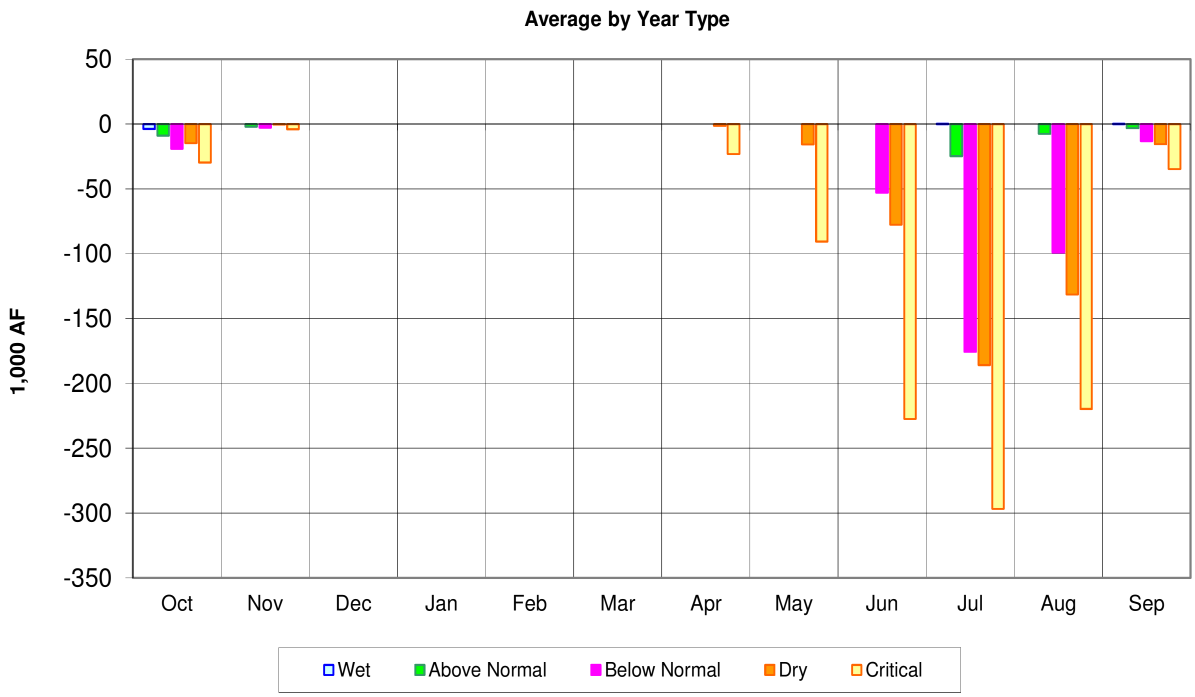


Figure 51 - CVP Sacramento Valley Settlement Contract Delivery for Existing (BO's)



CalSim II is designed to satisfy Sacramento CVP contracts at 100% in normal Shasta year types and 75% in critical Shasta year types and does not dynamically cut these diversions further than their contract allows. The SWRCB DFC require enough water from upstream reservoirs to cause them to hit dead pool and render them unable to satisfy these senior water rights as well as instream flow requirements. Deliveries are cut at the time upstream reservoirs hit dead pool resulting in unrealistic delivery patterns that are high in the spring and low during summer (**Figure 52**).

Figure 52 - Change in CVP Sacramento Valley Settlement Contract Delivery for Existing (BO's)



4.3 Characteristics of Hydropower Conditions with the SWRCB DFC

The SWRCB DFC causes the CVP and SWP to dramatically alter reservoir operations as described in the previous pages. Generally these operational changes lead to increased reservoir releases in the spring, decreased reservoir releases in the summer (see pages 16, 22, 25), decreased reservoir carryover storage (see pages 16, 22, 25), and decreased Delta export pumping. As a result of these changes, the timing and magnitude of generation at Project hydropower facilities is distorted from historical norms and the Project pumping loads associated with water deliveries south of the Delta shrink radically with the loss of exports (Average annual reduction in export = 2.8 MAF, see page 12).

As noted on page 19*, "The SWRCB DFC are very extreme and CalSim II was not designed to address these circumstances, therefore the logic that balances Trinity and Shasta Reservoir storage properly for existing (BO's) conditions may not be suitable when operating to satisfy the SWRCB flow criteria. Logic may need to be developed that isolates the Trinity operation from the Sacramento River Basin. Because Trinity River imports are increased in the SWRCB DFC model simulation there is likely an underestimate of hydropower impacts"*. The Trinity operations logic problem has not yet been addressed in CalSim II, but a rough attempt to compensate for this overly ambitious import of Trinity water and resulting increase in generation is presented as an alternative.

4.4 Hydropower Modeling Tools

CalSim II does not contain an ability to directly calculate hydropower production or use. Instead, power results are determined using CalSim II modeling results post-processed in two spreadsheet models, Long-Term Gen for the CVP and SWP Gen for the State water Project. Hydropower effects of the SWRCB DFC presented in this handout are determined as the difference between the existing conditions CalSim II study and the SWRCB DFC CalSim II study. By necessity, since CalSim II is a monthly time-step model, the hydropower results are presented as monthly values. Additional analyses on a shorter time-step may be desirable but presently available tools are not up to that task.

4.5 CVP and SWP Hydropower Results

The following pages, 50 through 71, contain the results of the monthly CVP and SWP hydropower analysis.

Figure 53 – Annual CVP Generation at Load Center

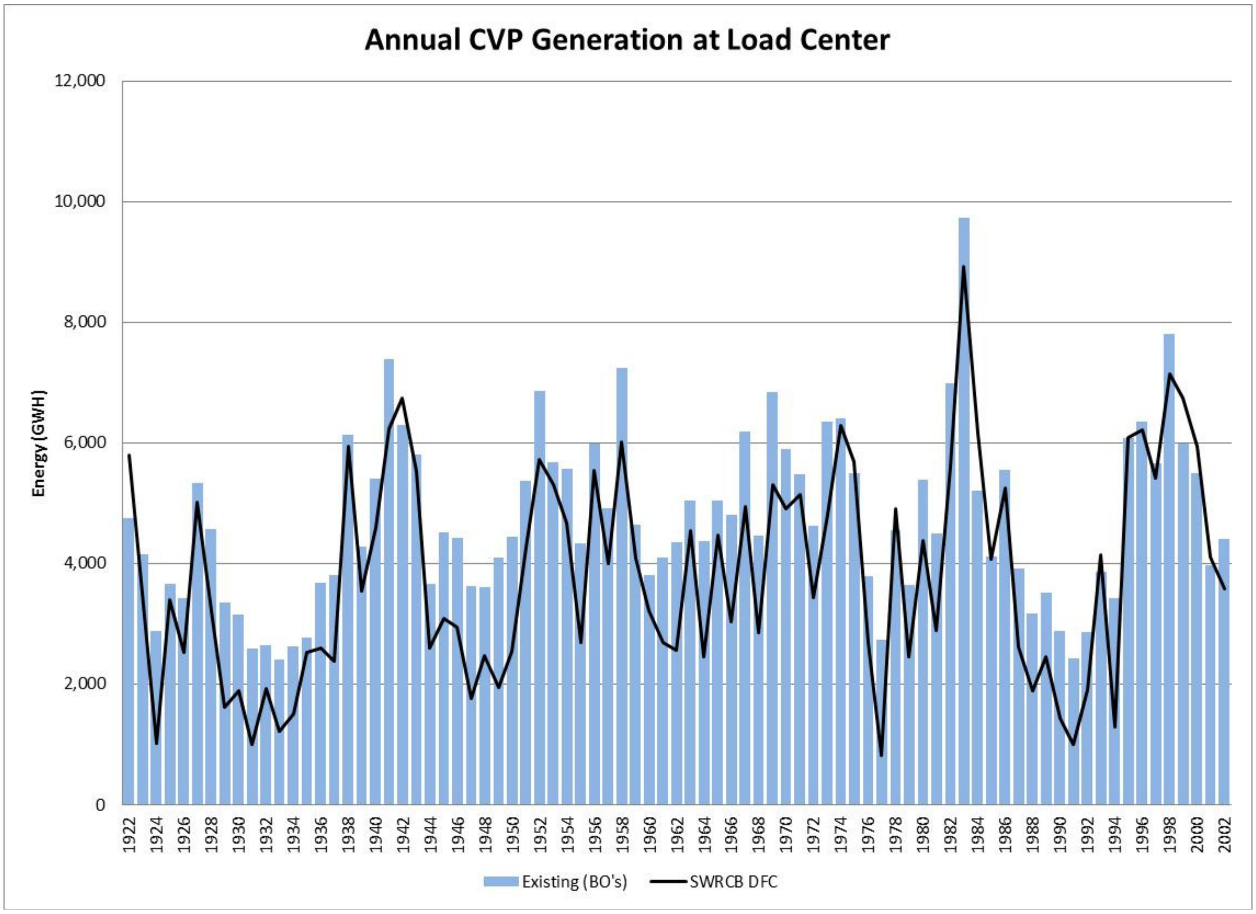


Table 2 – CVP Energy Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB Studies						
Existing (BO's)	6,263	5,016	4,090	3,850	3,079	4,714
SWRCB DFC	5,731	4,597	2,929	2,835	1,524	3,835
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	-532	-419	-1,162	-1,015	-1,555	-879
% Change	-8%	-8%	-28%	-26%	-51%	-19%

Figure 54 - Annual Net CVP Generation at Load Center

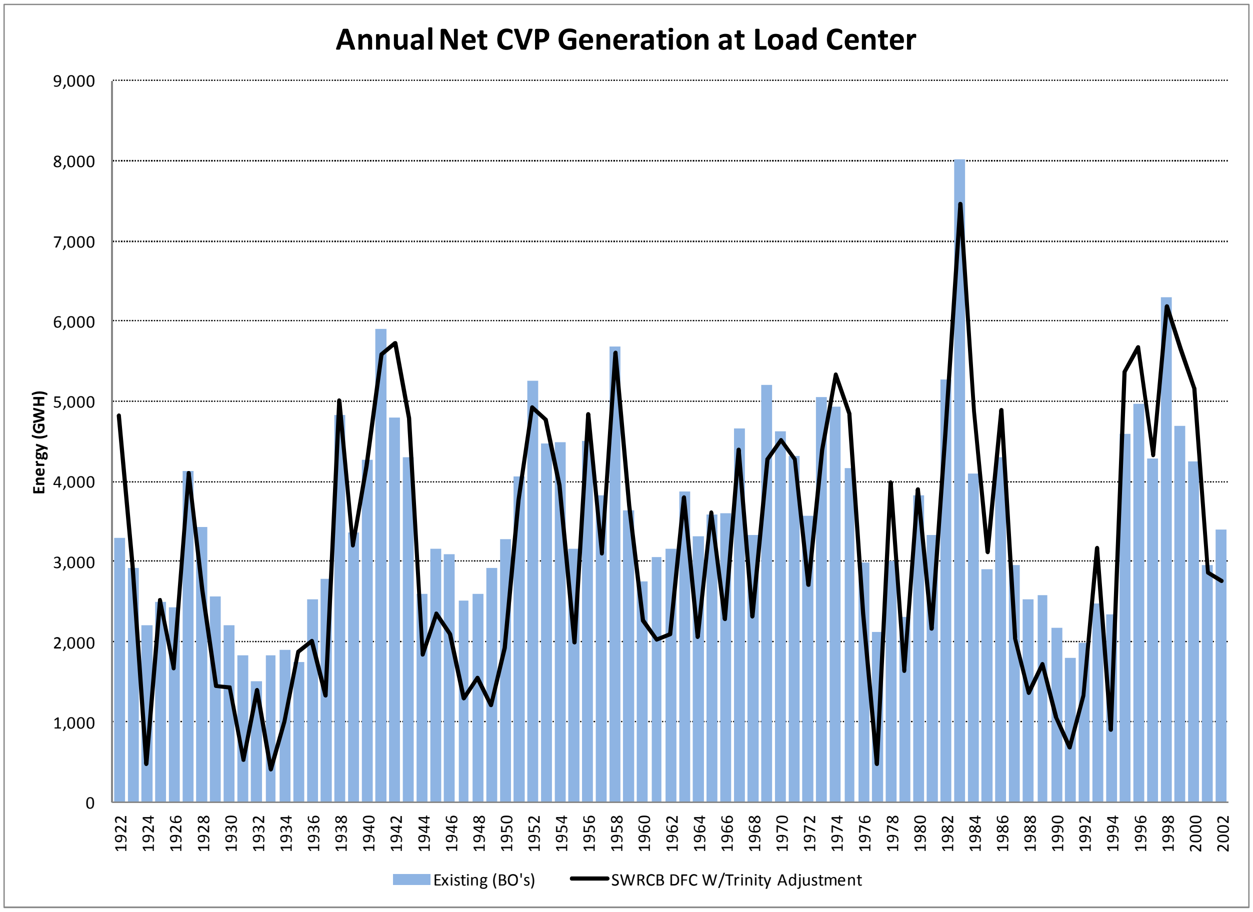


Table 3 - CVP Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC W/Trinity Adjustment Studies						
Existing (BO's)	6,263	5,016	4,090	3,850	3,079	4,714
SWRCB DFC W/Trinity Adjustment	5,550	4,287	2,717	2,640	1,538	3,656
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC W/Trinity Adjustment	-713	-730	-1,374	-1,210	-1,541	-1,058
% Change	-11%	-15%	-34%	-31%	-50%	-22%

Figure 55 – Annual SWP Generation at Load Center

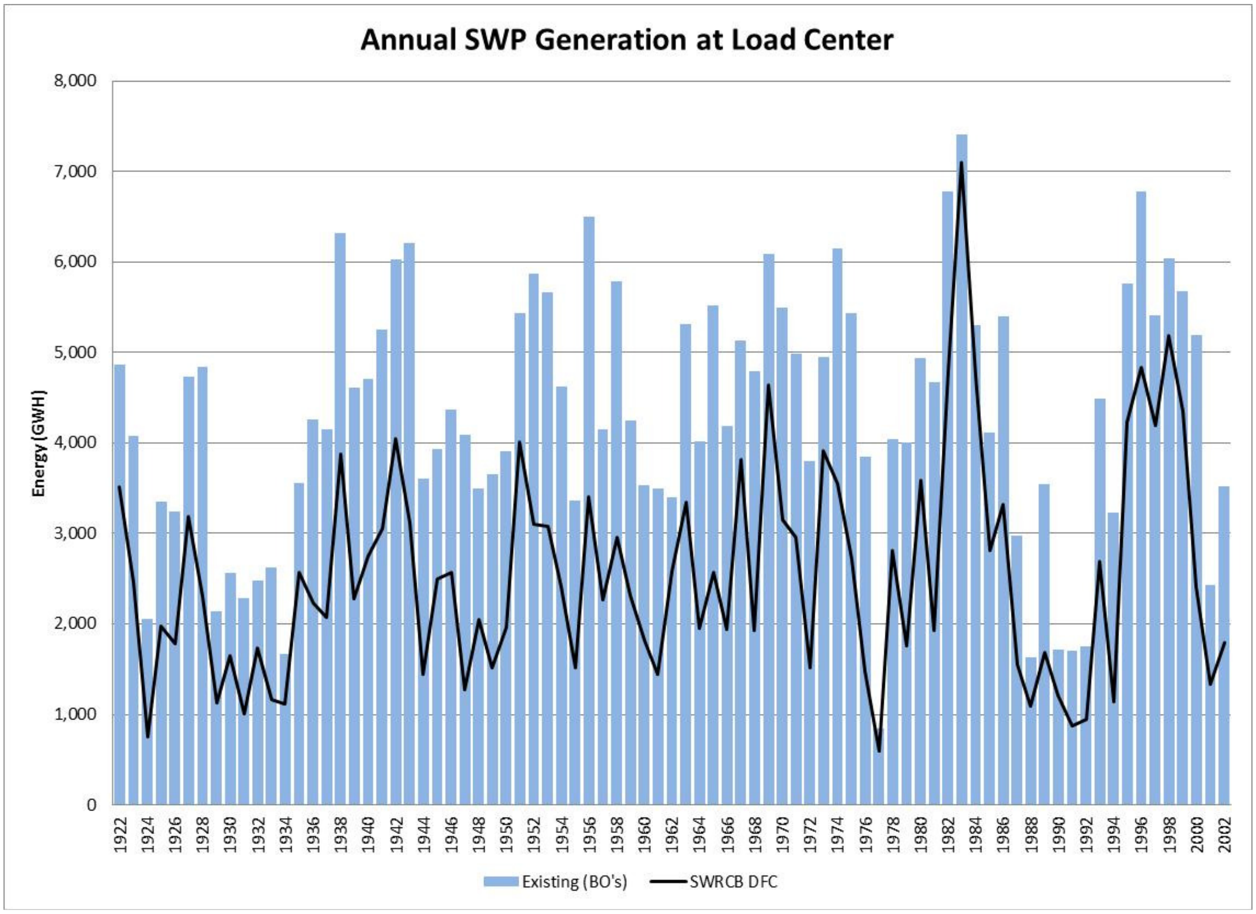


Table 4 – SWP Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC Studies						
Existing (BO's)	5,730	4,640	4,021	3,520	2,348	4,298
SWRCB DFC	3,956	2,808	1,984	1,766	1,126	2,556
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	-1,774	-1,832	-2,037	-1,754	-1,222	-1,742
% Change	-31%	-39%	-51%	-50%	-52%	-41%

Figure 56 - Annual CVP Project Use Load at Load Center

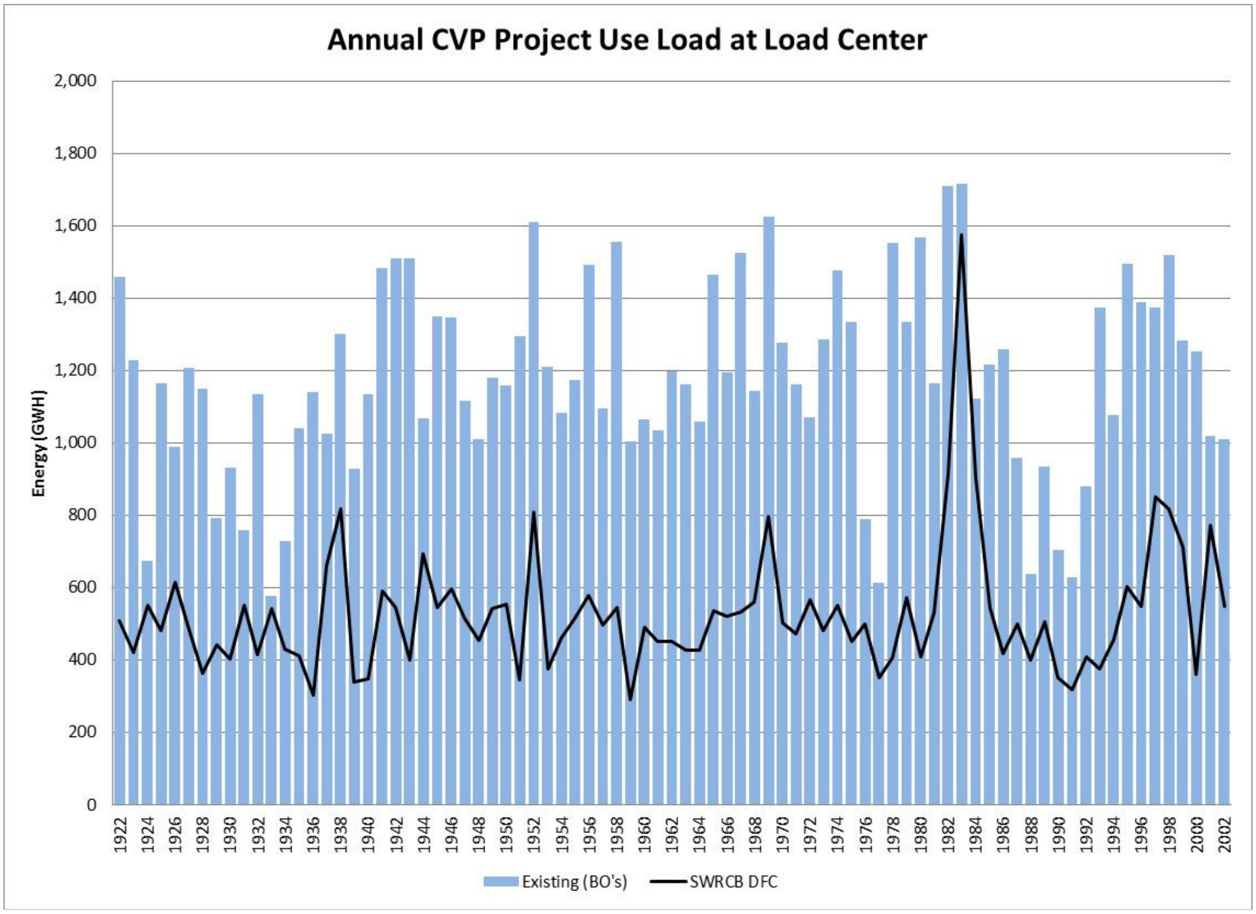


Table 5 - CVP PU Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC Studies						
Existing (BO's)	1,399	1,242	1,171	1,073	787	1,176
SWRCB DFC	706	487	430	467	403	530
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	-693	-756	-741	-605	-384	-646
% Change	-50%	-61%	-63%	-56%	-49%	-55%

Figure 57 - Annual CVP Project Use Load at Load Center

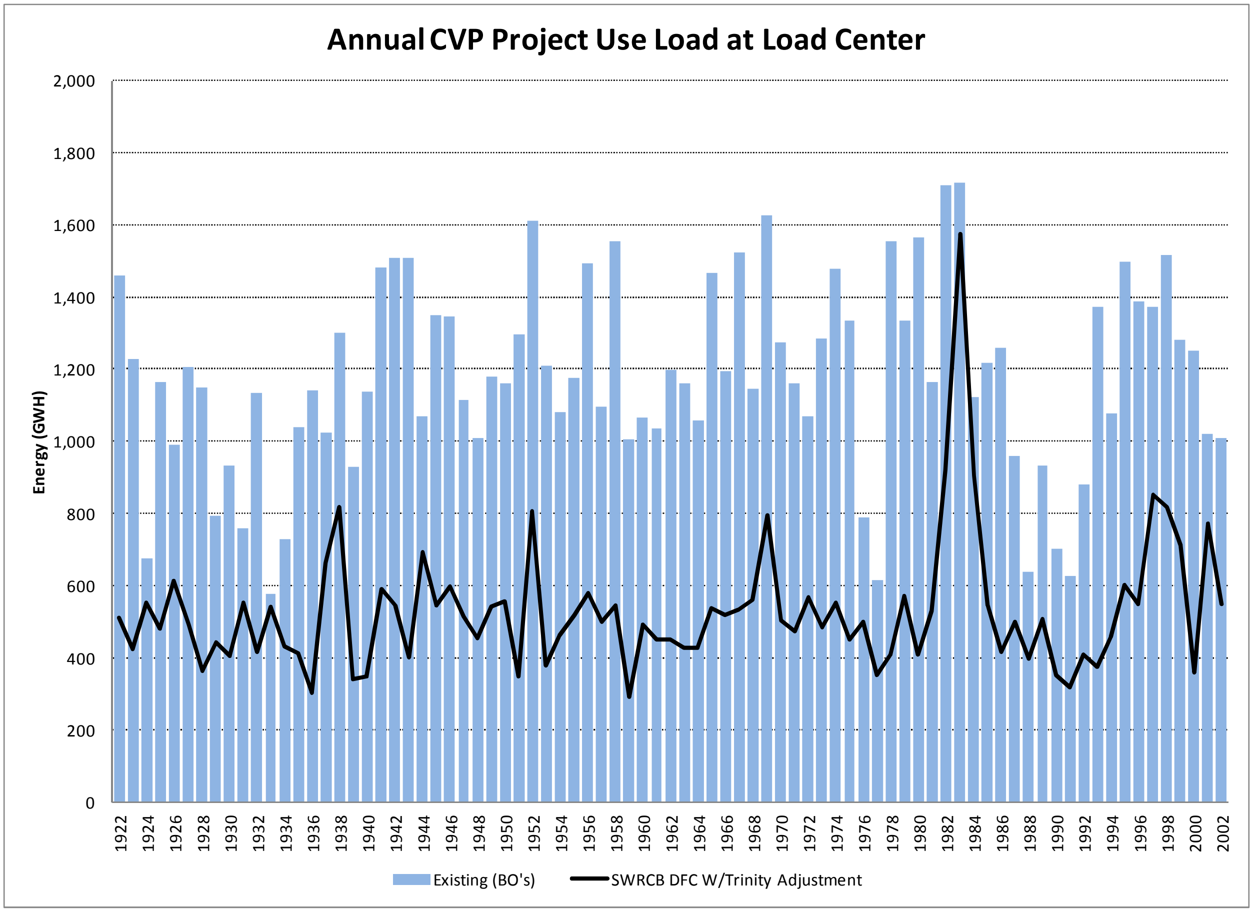


Table 6 - CVP PU Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC W/Trinity Adjustment Studies						
Existing (BO's)	1,399	1,242	1,171	1,073	787	1,176
SWRCB DFC W/Trinity Adjustment	706	487	430	467	403	530
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC W/Trinity Adjustment	-693	-756	-741	-605	-384	-646
% Change	-50%	-61%	-63%	-56%	-49%	-55%

Figure 58 - Annual SWP Project Use Load at Load Center

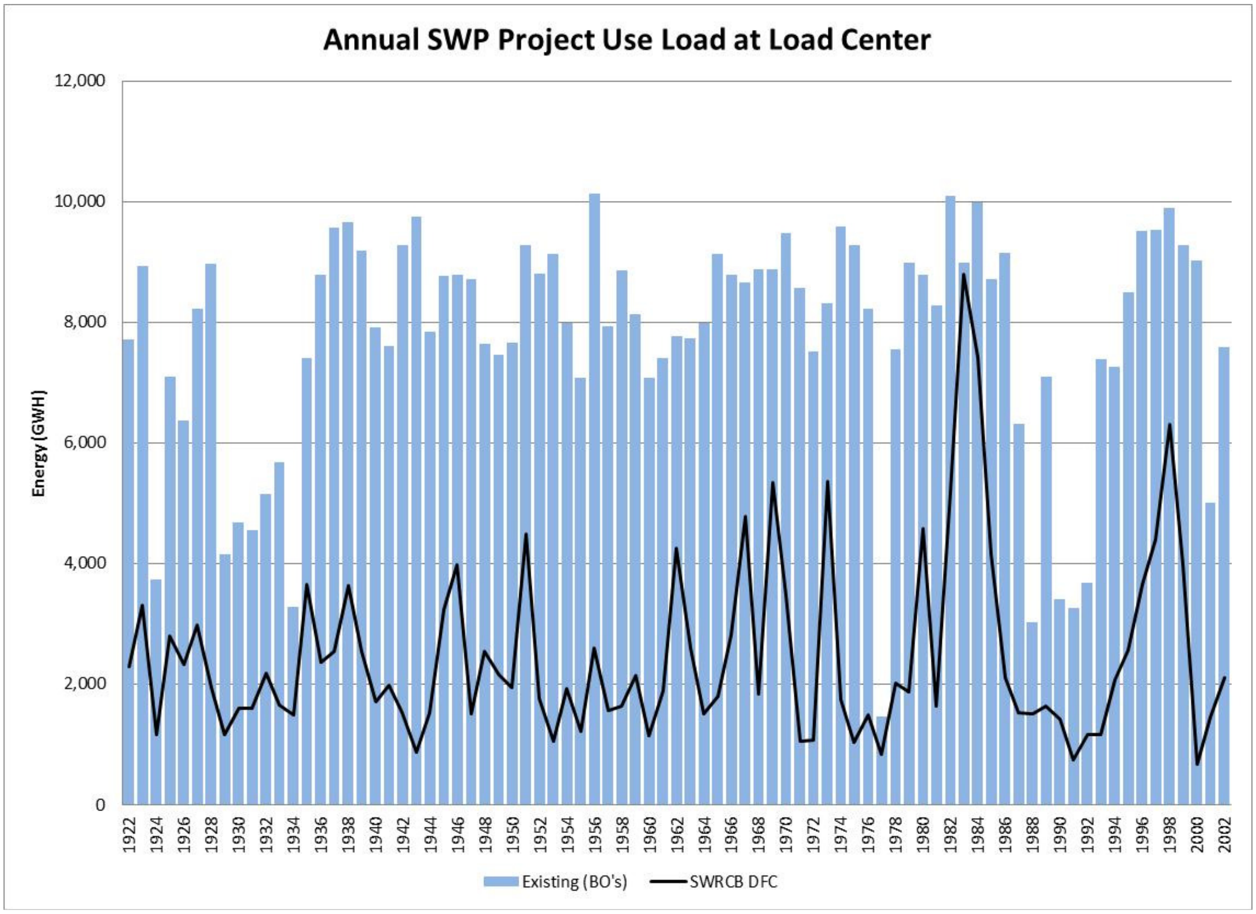


Table 7 - SWP PU Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC Studies						
Existing (BO's)	9,061	8,169	8,295	7,153	4,770	7,753
SWRCB DFC	3,427	2,442	2,084	2,178	1,574	2,508
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	-5,635	-5,726	-6,212	-4,975	-3,196	-5,245
% Change	-62%	-70%	-75%	-70%	-67%	-68%

Figure 59 - Annual Net CVP Generation at Load Center

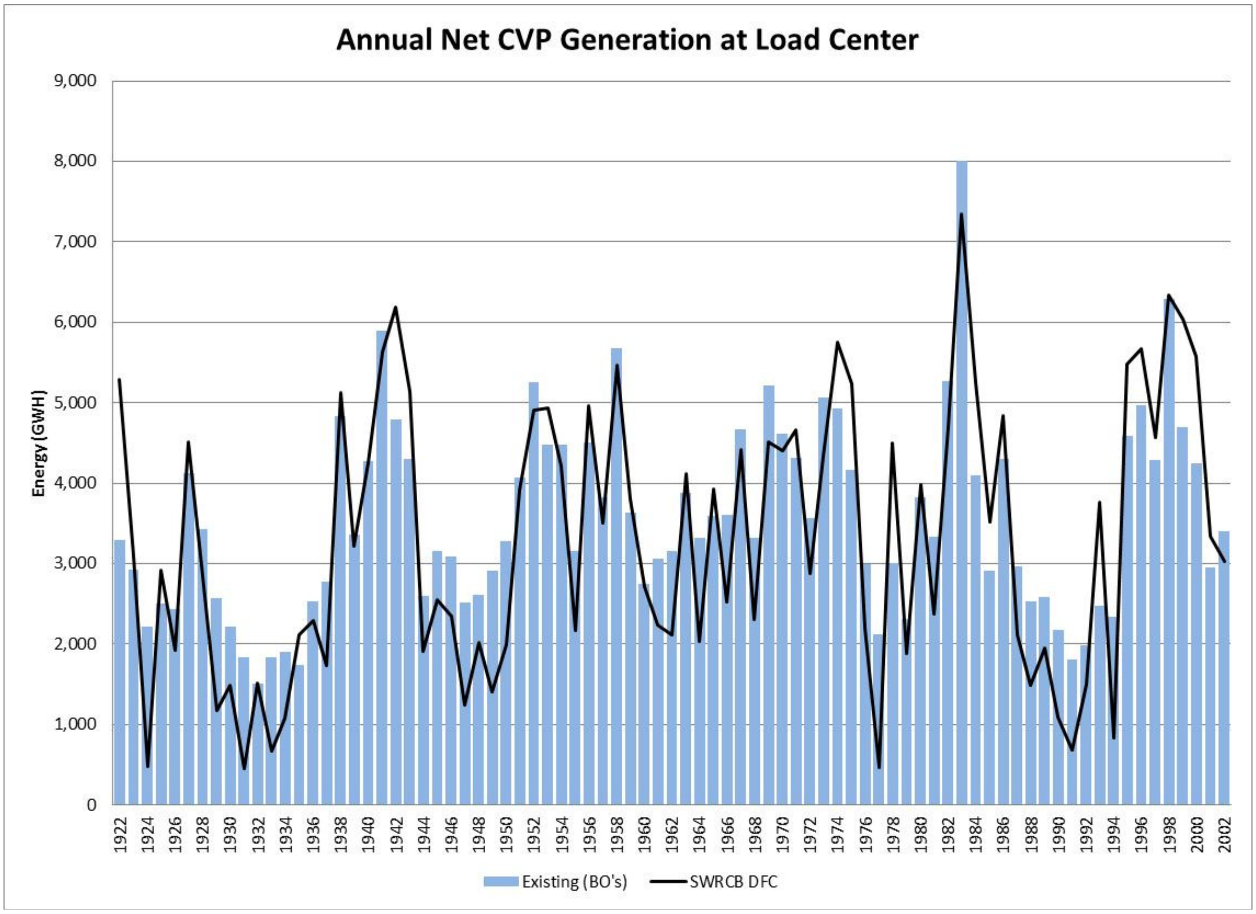


Table 8 - CVP Net Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC Studies						
Existing (BO's)	4,864	3,774	2,919	2,777	2,291	3,538
SWRCB DFC	5,025	4,110	2,499	2,368	1,120	3,305
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	162	336	-421	-409	-1,171	-233
% Change	3%	9%	-14%	-15%	-51%	-7%

Figure 60 - Annual CVP Generation at Load Center

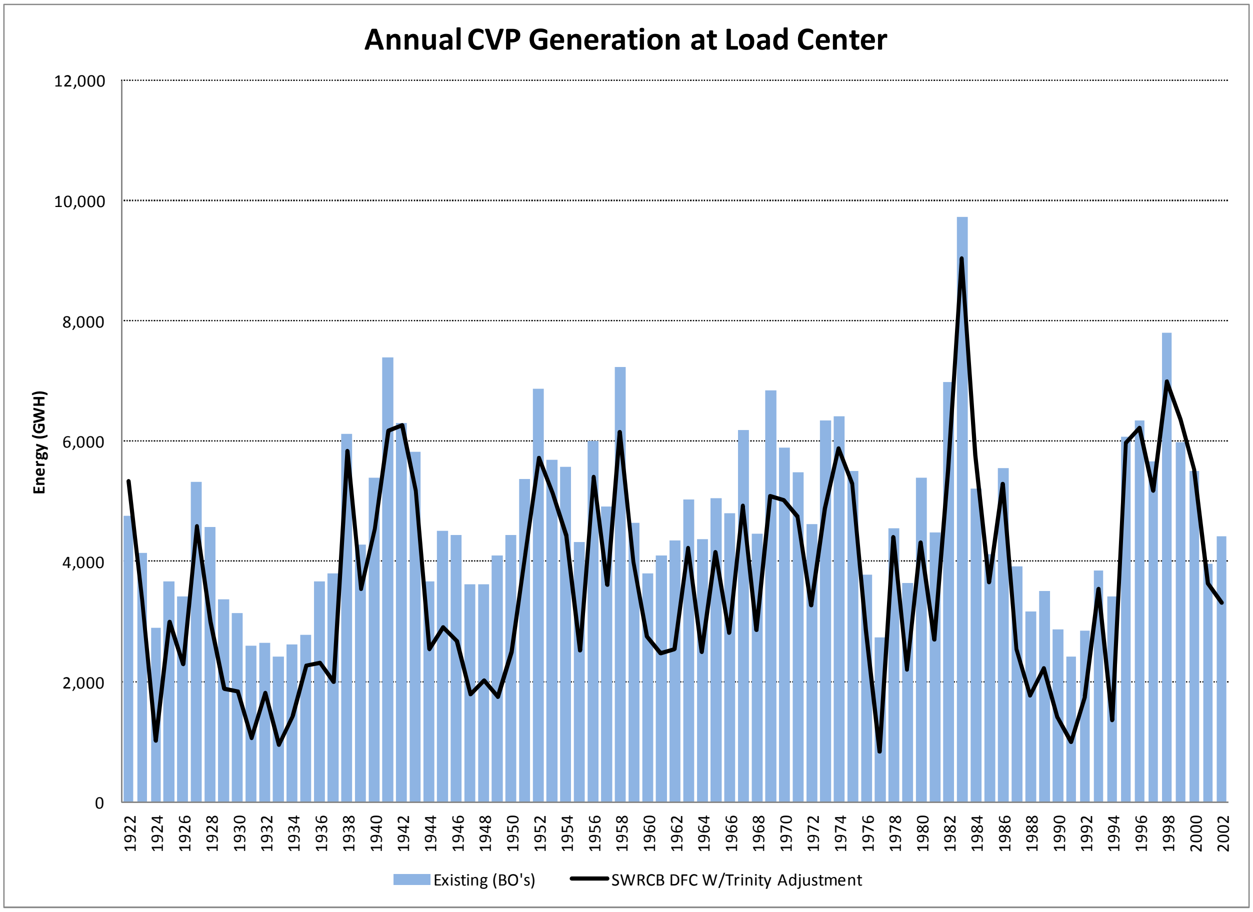


Table 9 - CVP Net Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC W/Trinity Adjustment Studies						
Existing (BO's)	4,864	3,774	2,919	2,777	2,291	3,538
SWRCB DFC W/Trinity Adjustment	4,844	3,800	2,287	2,173	1,135	3,126
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC W/Trinity Adjustment	-19	26	-633	-604	-1,157	-412
% Change	0%	1%	-22%	-22%	-50%	-12%

Figure 61 - Annual Net SWP Generation at Load Center

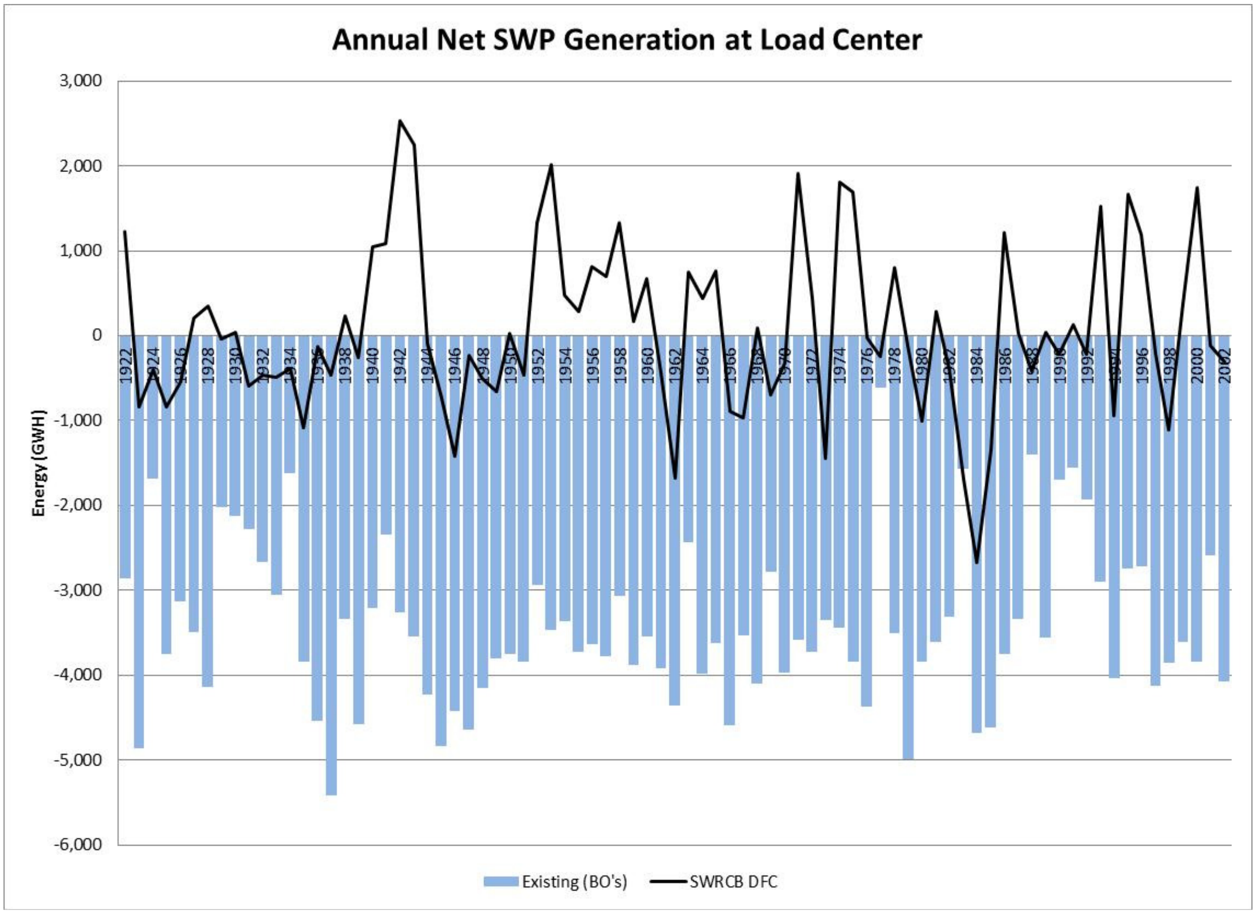
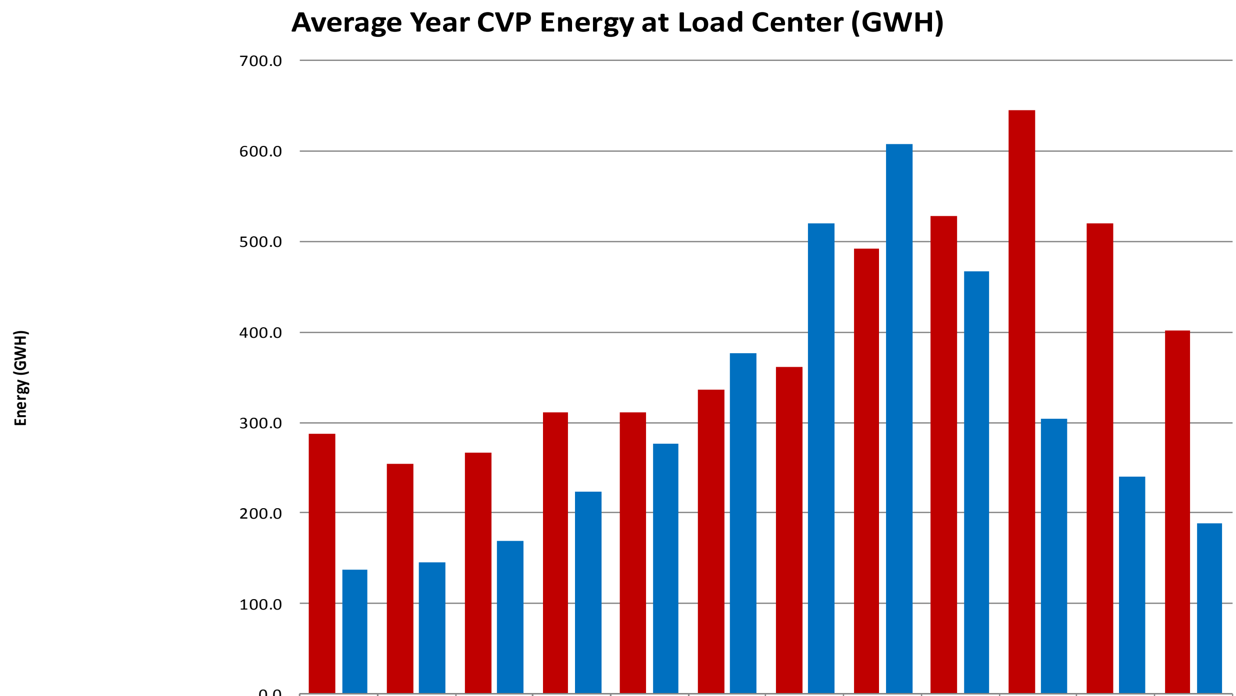


Table 10 - SWP Net Energy at Load Center (GWH)

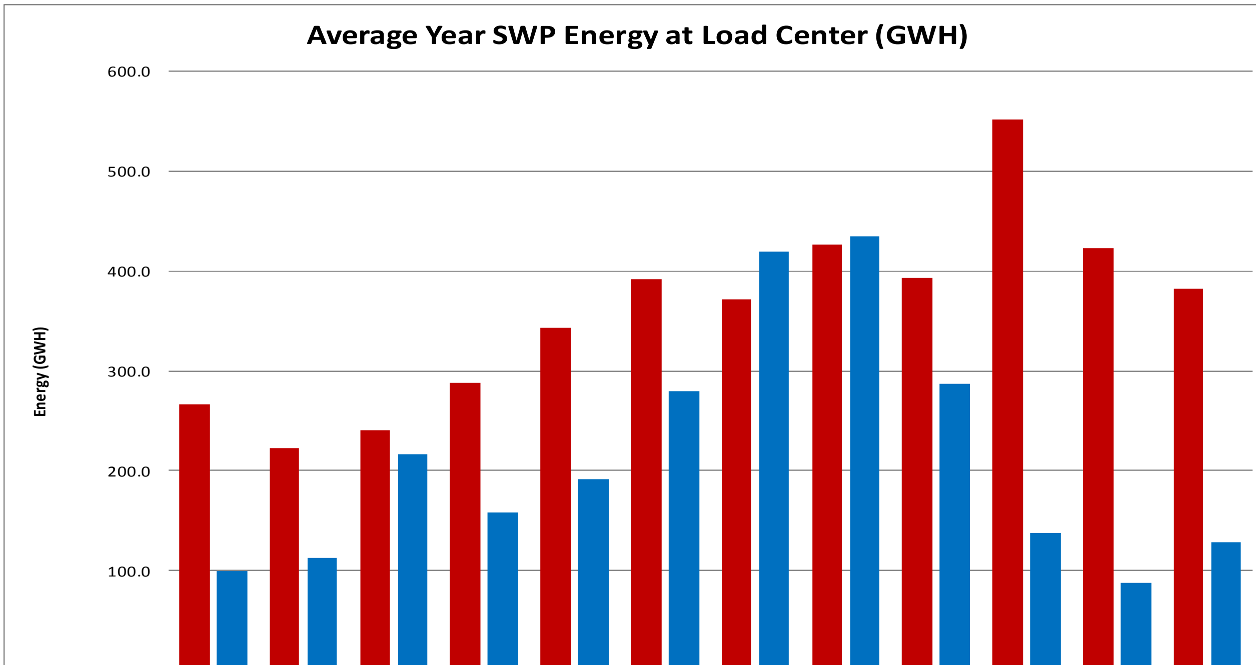
	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC Studies						
Existing (BO's)	-3,332	-3,529	-4,275	-3,633	-2,422	-3,455
SWRCB DFC	529	366	-100	-412	-448	48
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	3,861	3,895	4,175	3,221	1,974	3,503
% Change	116%	110%	98%	89%	82%	101%

Figure 62 - Average Year CVP Energy at Load Center (GWH)



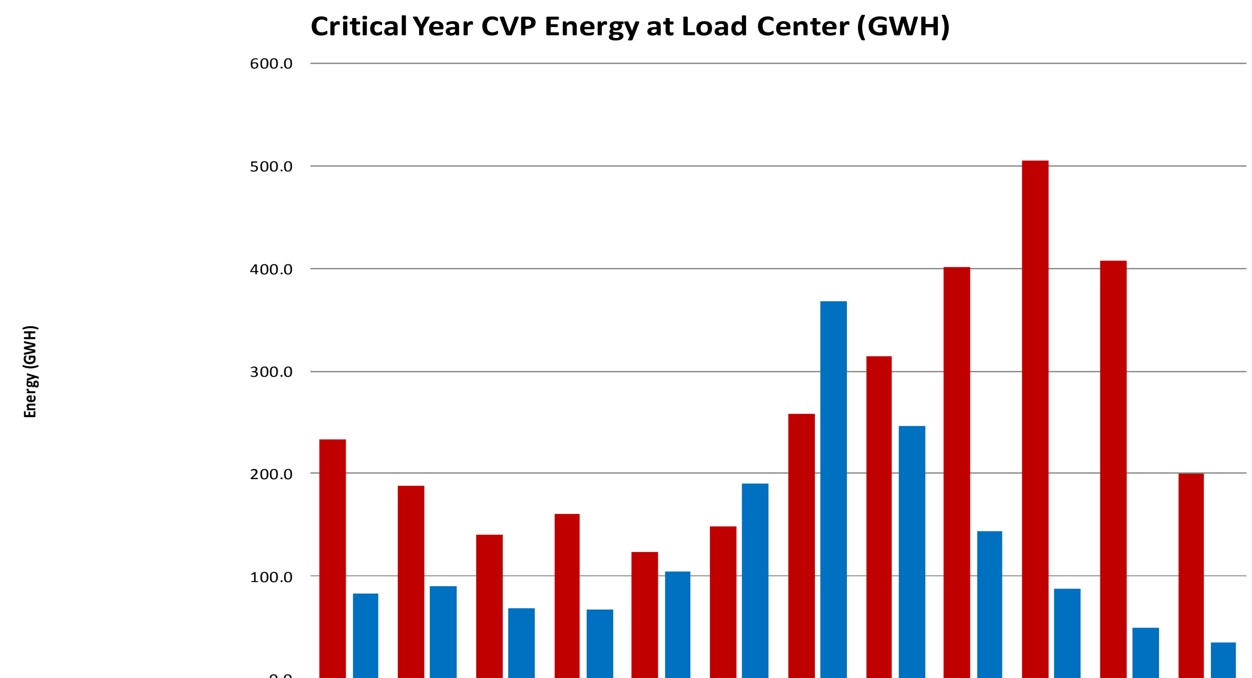
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	287.3	253.8	266.4	311.4	311.2	336.6	361.4	491.2	528.0	644.3	520.2	401.9
SWRCB DFC W/Trinity Adjustment	137.1	146.3	168.8	224.1	275.9	376.5	519.9	606.4	467.3	303.5	240.3	189.3

Figure 63 - Average Year SWP Energy at Load Center (GWH)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	267.1	222.4	240.6	287.7	342.8	391.6	370.9	426.8	393.2	551.4	422.2	381.8
SWRCB DFC	100.1	113.5	217.1	158.7	191.5	279.7	418.6	434.6	286.4	138.6	88.5	129.0

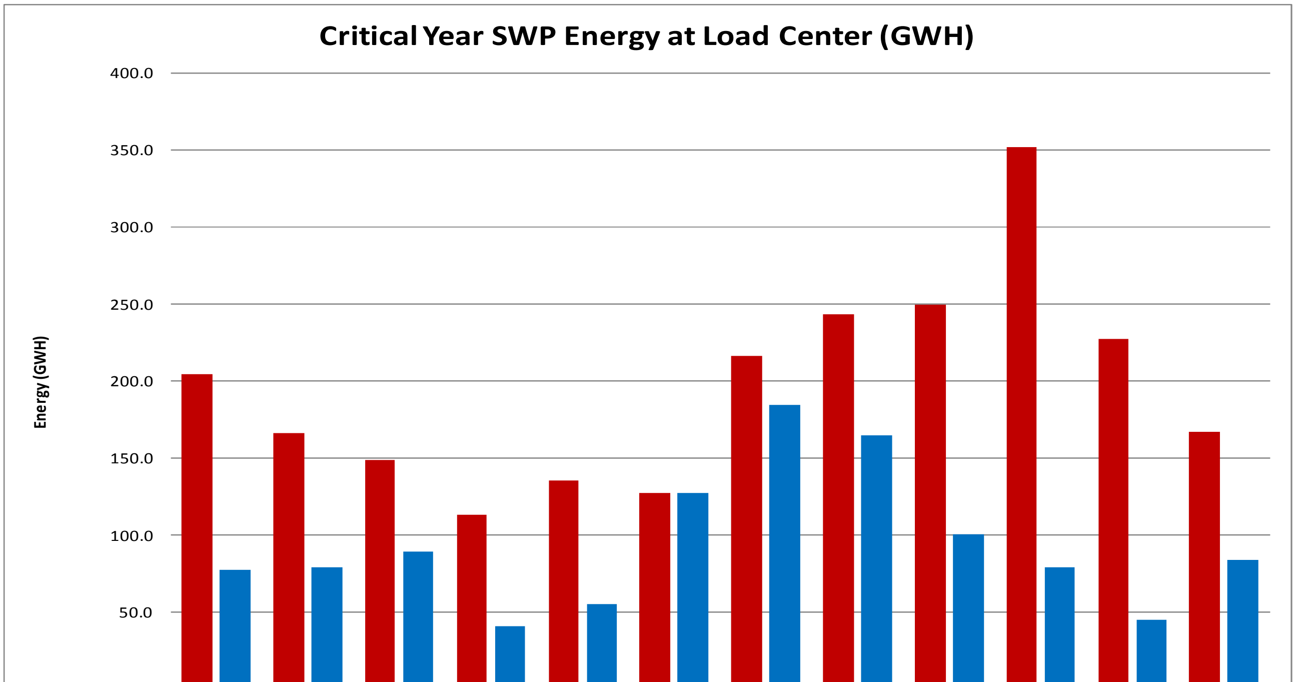
Figure 64 - Critical Year CVP Energy at Load Center (GWH)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	232.8	188.4	139.8	160.3	123.4	148.3	257.8	314.6	401.0	504.7	407.0	200.4
SWRCB DFC W/Trinity Adjustment	82.9	90.0	69.1	67.3	104.7	190.8	368.2	246.8	143.4	88.2	50.1	36.2

Existing (BO's) SWRCB DFC W/Trinity Adjustment

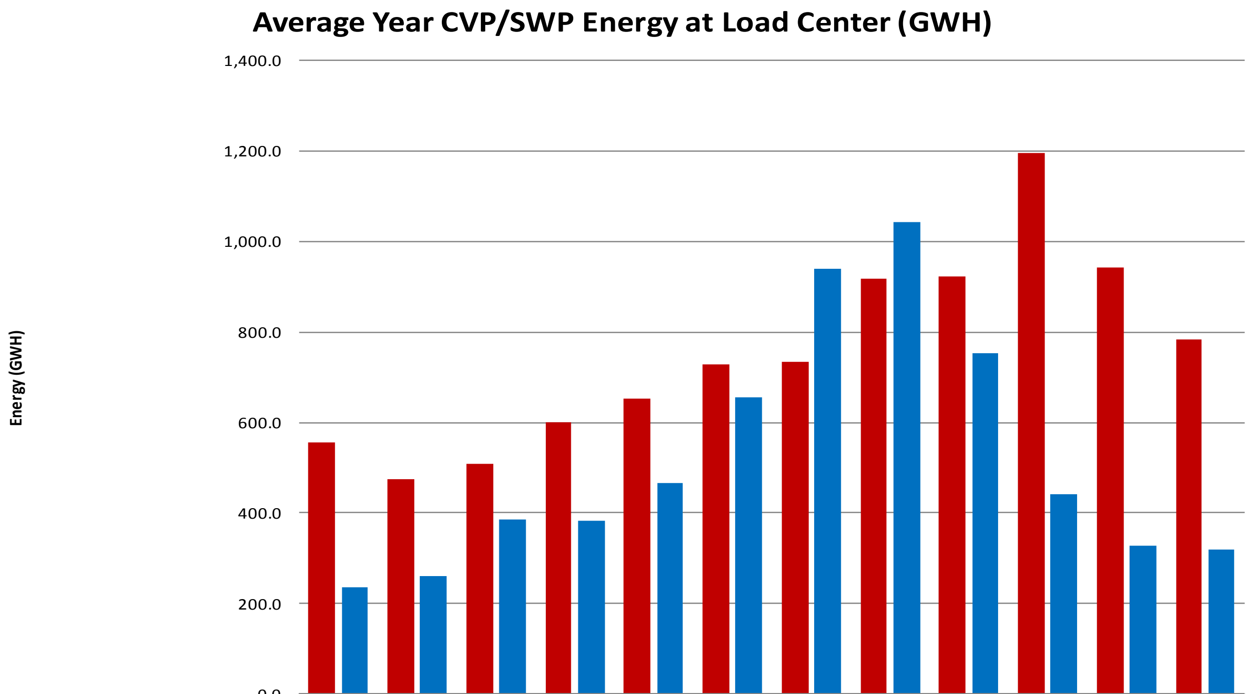
Figure 65 - Critical Year CVP Energy at Load Center (GWH)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	204.1	166.4	148.7	113.3	135.1	127.5	215.9	242.7	249.1	351.3	227.0	166.7
SWRCB DFC	77.4	79.1	89.2	40.6	55.2	127.1	184.5	164.8	100.3	78.9	45.0	84.0

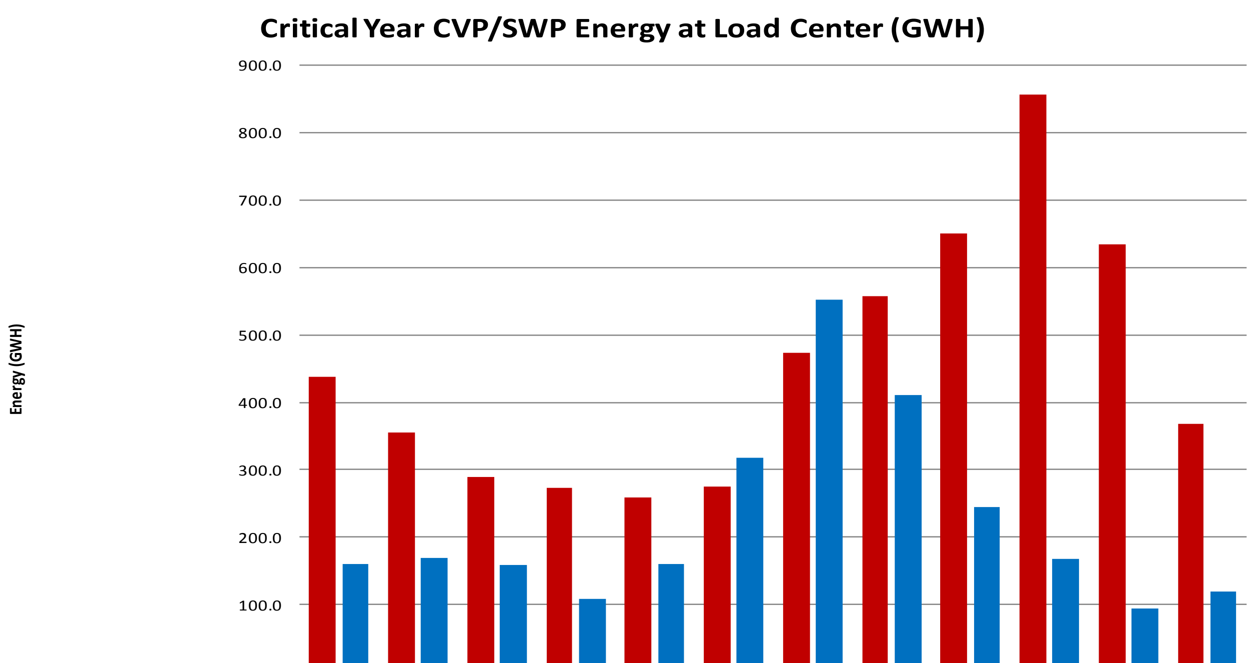
Existing (BO's) SWRCB DFC

Figure 66 - Average Year CVP/SWP Energy at Load Center (GWH)



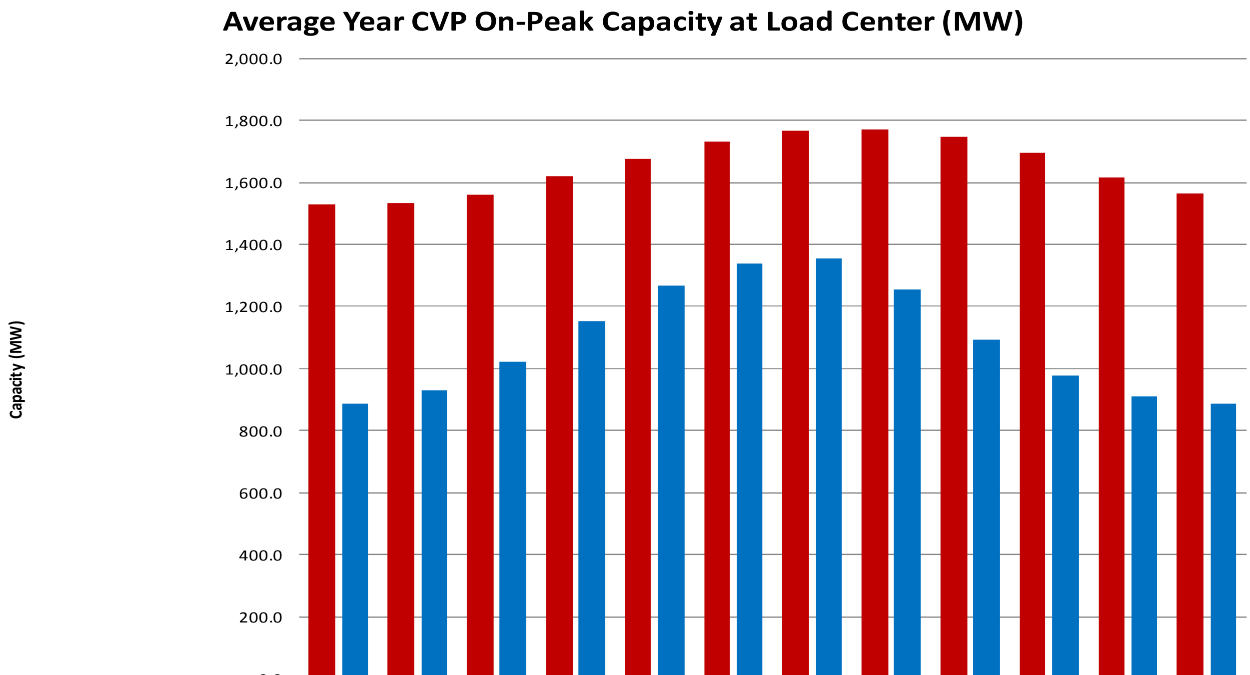
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	554.5	476.2	506.9	599.1	654.0	728.2	732.3	918.1	921.2	1,195.7	942.4	783.7
SWRCB DFC W/Trinity Adjustment	237.2	259.9	385.9	382.8	467.5	656.2	938.6	1,041.0	753.7	442.1	328.8	318.3

Figure 67 - Critical Year CVP/SWP Energy at Load Center (GWH)



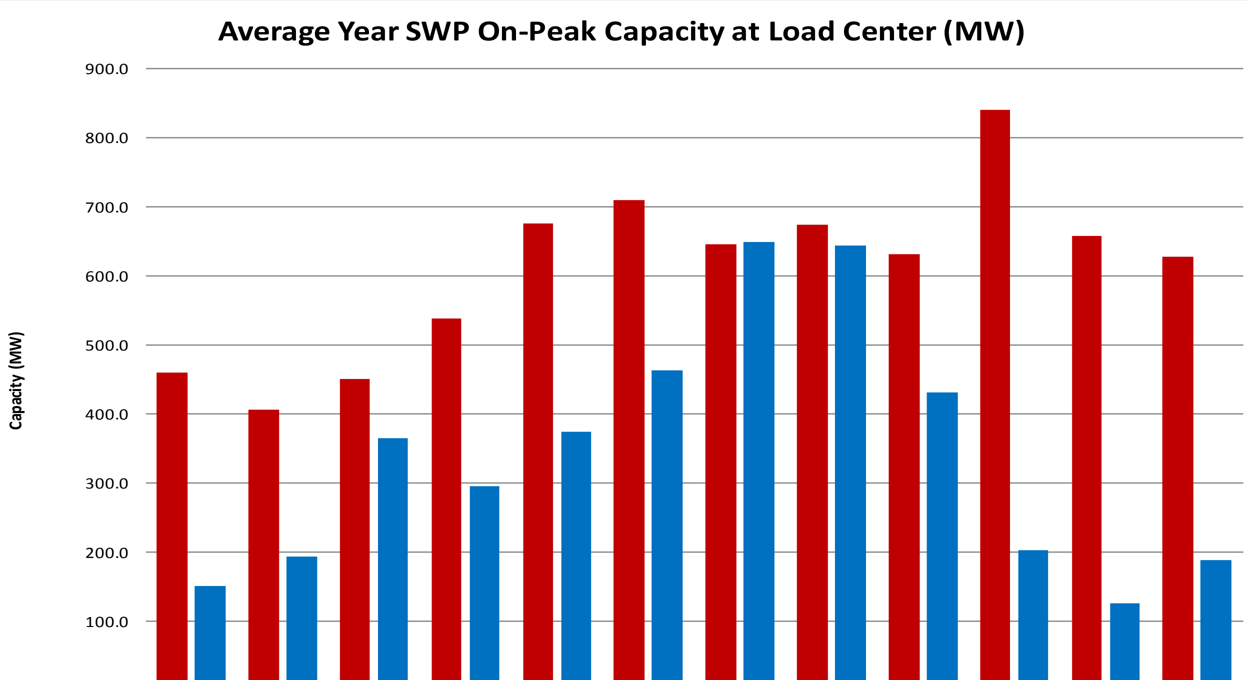
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	436.9	354.8	288.5	273.6	258.5	275.8	473.7	557.4	650.1	856.1	634.0	367.1
SWRCB DFC W/Trinity Adjustment	160.3	169.1	158.3	108.0	159.9	317.9	552.7	411.6	243.8	167.1	95.1	120.2

Figure 68 - Average Year CVP On-Peak Capacity at Load Center (MW)



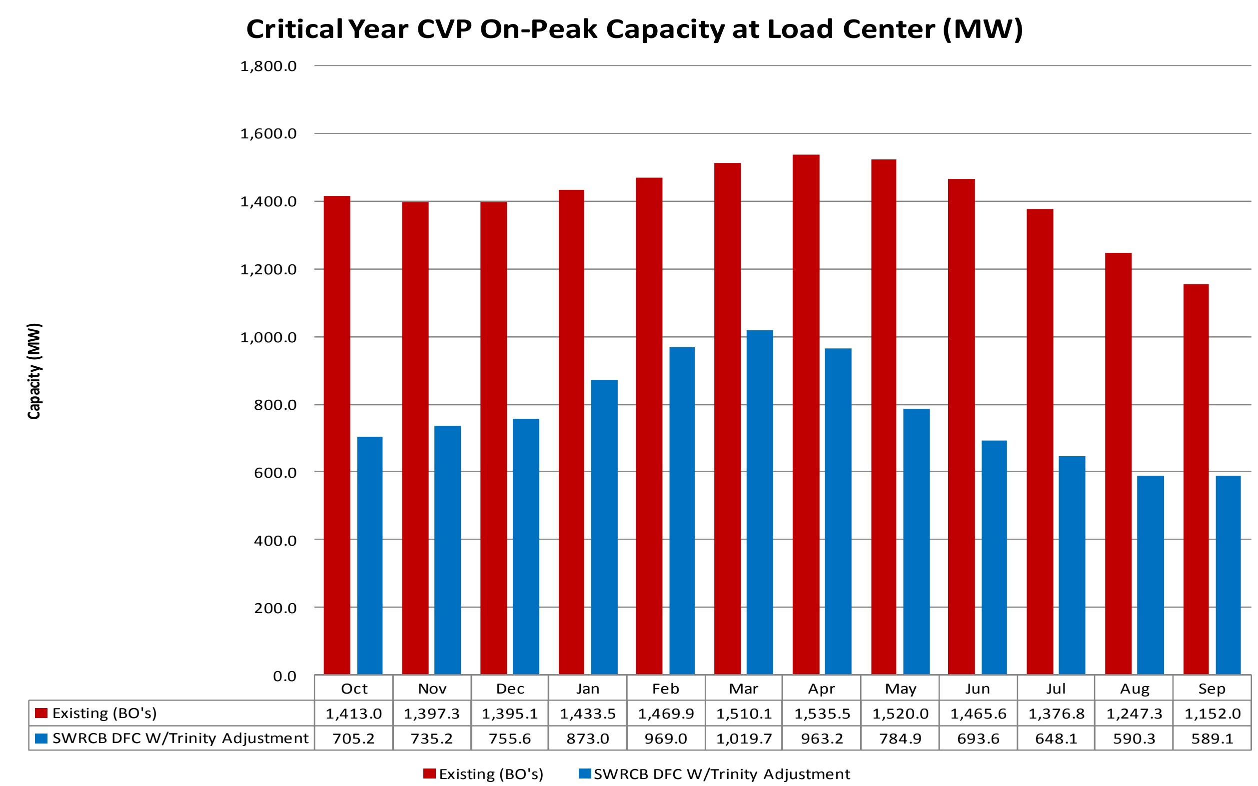
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	1,529.8	1,533.0	1,561.3	1,620.3	1,677.0	1,730.0	1,765.2	1,770.6	1,748.0	1,694.6	1,614.6	1,563.0
SWRCB DFC W/Trinity Adjustment	888.3	930.6	1,020.7	1,152.6	1,265.2	1,340.0	1,354.3	1,253.8	1,093.5	977.9	910.1	887.0

Figure 69 - Average Year SWP On-Peak Capacity at Load Center (MW)



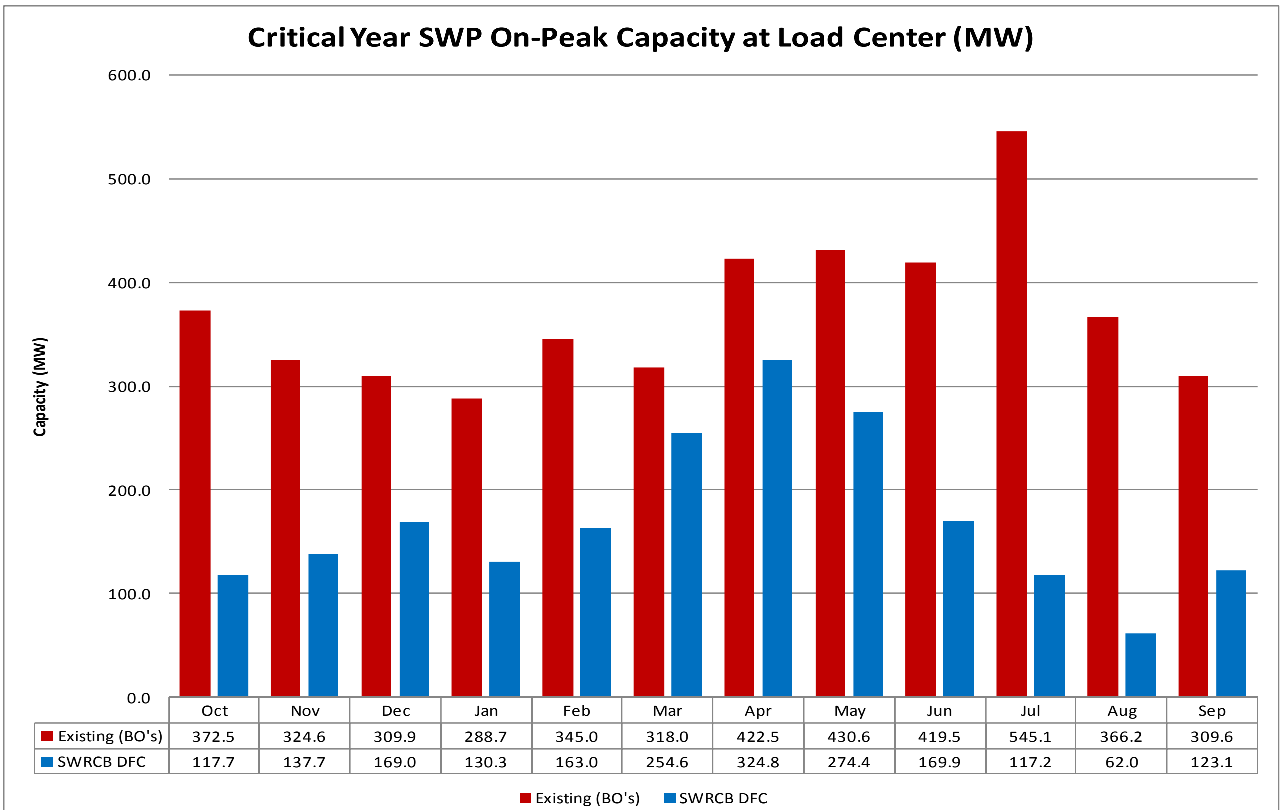
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	459.1	406.8	450.9	538.9	676.0	709.3	644.7	674.2	631.1	839.6	657.1	626.8
SWRCB DFC	150.4	193.6	364.8	295.2	373.8	462.4	649.5	643.6	430.6	202.9	125.9	187.9

Figure 70 - Critical Year CVP Energy On-Peak Capacity at Load Center (MW)



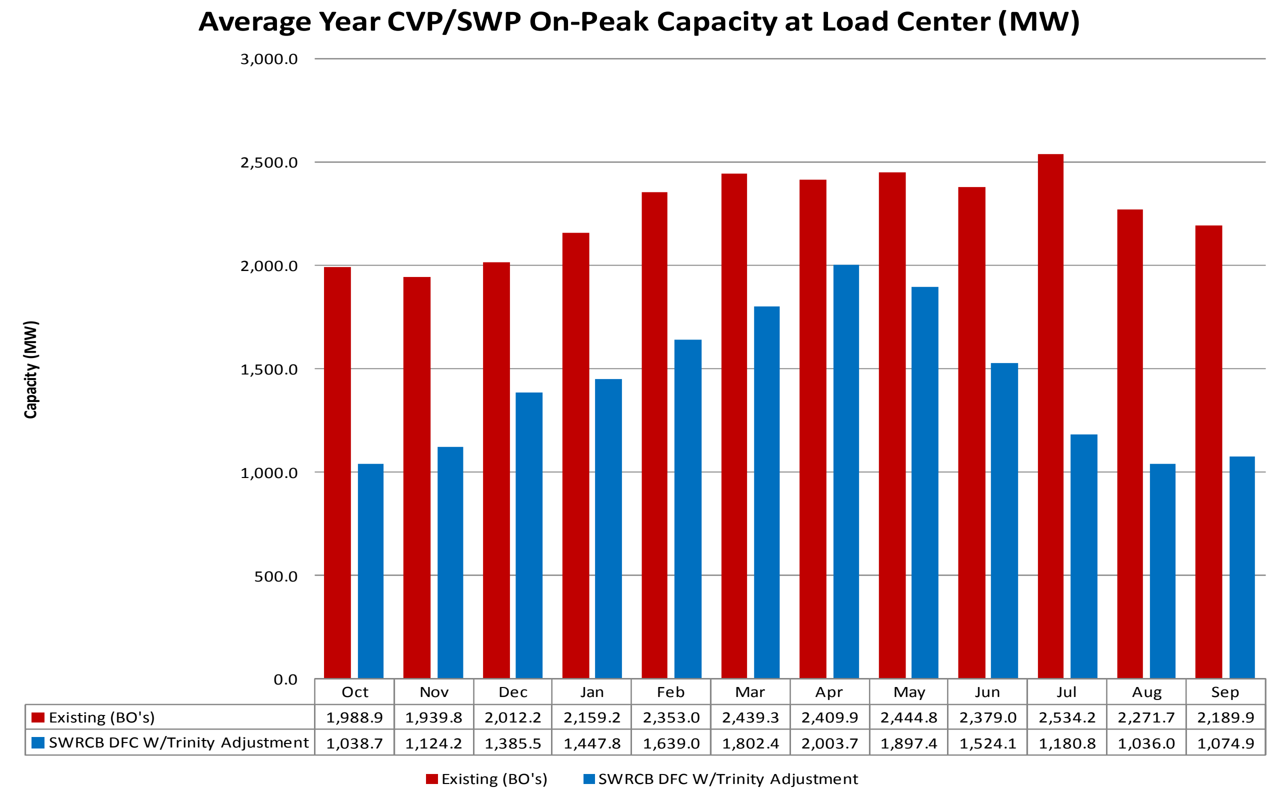
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	1,413.0	1,397.3	1,395.1	1,433.5	1,469.9	1,510.1	1,535.5	1,520.0	1,465.6	1,376.8	1,247.3	1,152.0
SWRCB DFC W/Trinity Adjustment	705.2	735.2	755.6	873.0	969.0	1,019.7	963.2	784.9	693.6	648.1	590.3	589.1

Figure 71 - Critical Year SWP On-Peak Capacity at Load Center (MW)



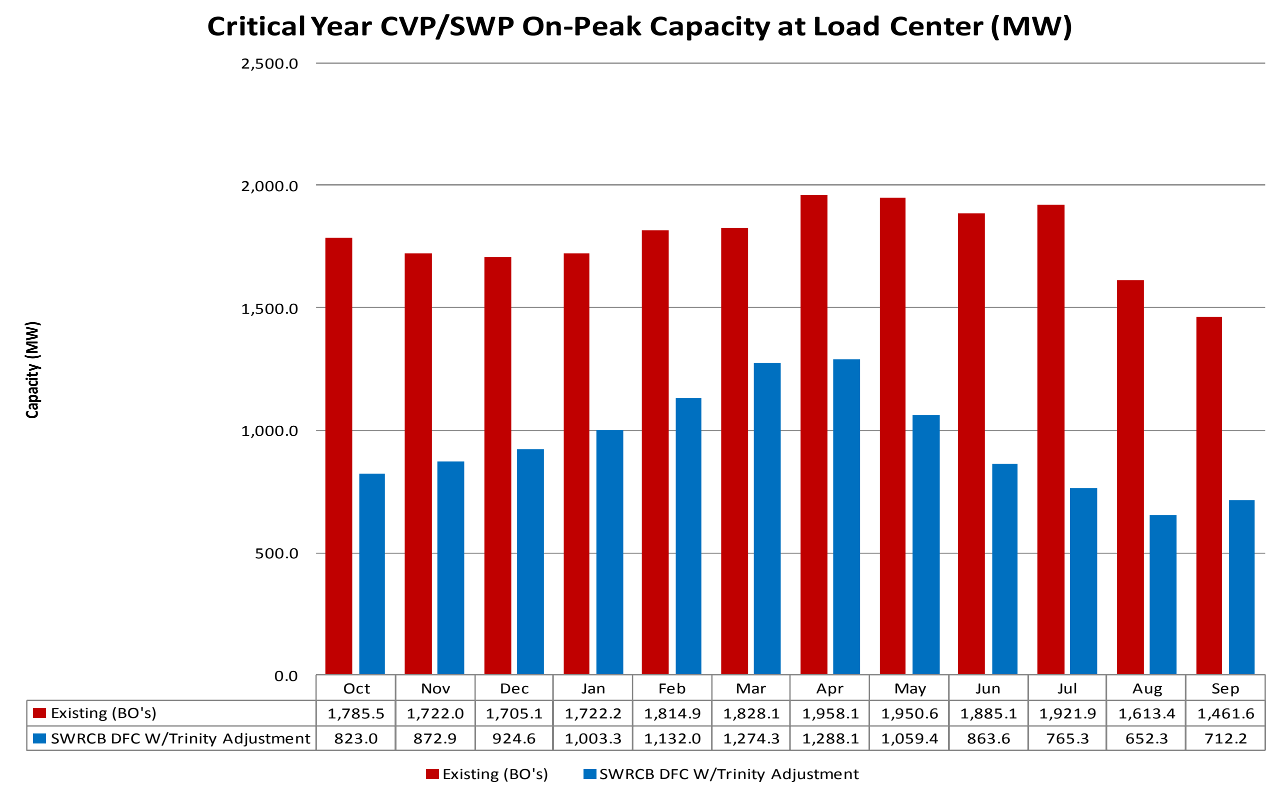
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	372.5	324.6	309.9	288.7	345.0	318.0	422.5	430.6	419.5	545.1	366.2	309.6
SWRCB DFC	117.7	137.7	169.0	130.3	163.0	254.6	324.8	274.4	169.9	117.2	62.0	123.1

Figure 72 - Average Year CVP/SWP On-Peak Capacity at Load Center (MW)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	1,988.9	1,939.8	2,012.2	2,159.2	2,353.0	2,439.3	2,409.9	2,444.8	2,379.0	2,534.2	2,271.7	2,189.9
SWRCB DFC W/Trinity Adjustment	1,038.7	1,124.2	1,385.5	1,447.8	1,639.0	1,802.4	2,003.7	1,897.4	1,524.1	1,180.8	1,036.0	1,074.9

Figure 73 - Critical Year CVP/SWP On-Peak Capacity at Load Center (MW)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing (BO's)	1,785.5	1,722.0	1,705.1	1,722.2	1,814.9	1,828.1	1,958.1	1,950.6	1,885.1	1,921.9	1,613.4	1,461.6
SWRCB DFC W/Trinity Adjustment	823.0	872.9	924.6	1,003.3	1,132.0	1,274.3	1,288.1	1,059.4	863.6	765.3	652.3	712.2

Table 11 - Combined CVP/SWP Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC W/Trinity Adjustment Studies						
Existing (BO's)	11,992	9,656	8,111	7,370	5,426	9,012
SWRCB DFC W/Trinity Adjustment	9,506	7,095	4,700	4,406	2,664	6,212
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC W/Trinity Adjustment	-2,486	-2,561	-3,411	-2,964	-2,763	-2,800
% Change	-21%	-27%	-42%	-40%	-51%	-31%

Table 12 - Combined CVP/SWP Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC W/Trinity Adjustment Studies						
Existing (BO's)	10,460	9,411	9,466	8,226	5,557	8,929
SWRCB DFC W/Trinity Adjustment	4,132	2,929	2,514	2,645	1,977	3,038
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC W/Trinity Adjustment	-6,328	-6,482	-6,953	-5,581	-3,580	-5,891
% Change	-60%	-69%	-73%	-68%	-64%	-66%

Table - Combined CVP/SWP Net Energy at Load Center (GWH)

	Water Year Type					
	Wet	Above Normal	Below Normal	Dry	Critical	All Years
Existing (BO's) and SWRCB DFC W/Trinity Adjustment Studies						
Existing (BO's)	1,532	245	-1,355	-856	-131	83
SWRCB DFC W/Trinity Adjustment	5,374	4,166	2,187	1,761	687	3,174
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC W/Trinity Adjustment	3,841	3,921	3,542	2,617	818	3,091
% Change	251%	1601%	261%	306%	625%	3711%

Table 13 – Power and Pumping Cost Report Metrics, CVP Long-Term Gen Model Results

Power and Pumping Cost Reporting Metrics

CVP Long-Term Gen Model Results					Existing	SWRCB DFC W/TRN Adj	Difference
CVP Facilities							
Power Facilities							
	Capacity	Total of all Facilities at load center	(MW)	Long Term	1,650	1,088	-563
				Driest Periods	1,368	786	-581
	Energy Generation	Total of all Facilities at load center	(GWh)	Long Term	4,709	3,651	-1,058
				Driest Periods	3,004	1,669	-1,336
	Generation Revenue	Total of all Facilities	($1,000)	Long Term	276,795	206,417	-70,378
				Driest Periods	177,262	91,956	-85,306
Pumping Facilities							
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	1,176	529	-647
				Driest Periods	790	437	-353
	Power Costs	Total of all Facilities	($1,000)	Long Term	60,770	27,562	-33,208
				Driest Periods	41,127	22,983	-18,144
Losses							
	Foregone Energy	Total of all Facilities	(GWh)	Long Term	255	274	19
				Driest Periods	20	51	31
	Transmission Losses	Total of all Facilities	(GWh)	Long Term	201	156	-45
				Driest Periods	128	68	-59
Tot al							
	Net Generation	Total of all Facilities	(GWh)	Long Term	3,533	3,122	-411
				Driest Periods	2,214	1,231	-983
	Net Revenue	Total of all Facilities	($1,000)	Long Term	216,024	178,855	-37,170
				Driest Periods	136,135	68,973	-67,162

Notes:
1. Long Term is the average quantity for the calendar years 1922-2002.
2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.
3. 2009 Forecast (in 2007 $); Prices are forward prices as of 08/25/2009 and were developed by DWR power portfolio section.(extrapolated from a linear trend that was fitted to the estimates beginning in late 2009 and ending in 2039)

Table 14 - Power and Pumping Cost Report Metrics, SWP Gen Results

Power and Pumping Cost Reporting Metrics

SWP Gen Results					Existing	SWRCB DFC	Difference
SWP Facilities							
Power Facilities							
	Capacity	Total of all Facilities at load center	(MW)	Long Term	610	339	-271
				Driest Periods	364	186	-179
	Energy Generation	Total of all Facilities at load center	(GWh)	Long Term	4,299	2,548	-1,750
				Driest Periods	2,269	1,229	-1,040
	Generation Revenue	Total of all Facilities	($1,000)	Long Term	248,338	141,999	-106,338
				Driest Periods	131,298	68,415	-62,883
Pumping Facilities							
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	7,740	2,479	-5,261
				Driest Periods	4,570	1,433	-3,137
	Power Costs	Total of all Facilities	($1,000)	Long Term	402,469	127,827	-274,641
				Driest Periods	236,799	73,590	-163,209
Losses							
	Foregone Energy	Total of all Facilities	(GWh)	Long Term	75	78	3
				Driest Periods	1	5	4
	Transmission Losses	Total of all Facilities	(GWh)	Long Term	141	101	-39
				Driest Periods	71	48	-23
Total							
	Net Generation	Total of all Facilities	(GWh)	Long Term	-3,441	69	3,511
				Driest Periods	-2,300	-204	2,097
	Net Revenue	Total of all Facilities	($1,000)	Long Term	-154,131	14,172	168,303
				Driest Periods	-105,501	-5,175	100,326

Notes:
1. Long Term is the average quantity for the calendar years 1922-2002.
2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.
3. 2009 Forecast (in 2007 $); Prices are forward prices as of 08/25/2009 and were developed by DWR power portfolio section.(extrapolated from a linear trend that was fitted to the estimates beginning in late 2009 and ending in 2039)

4.6 Cost Estimates for Loss of M&I Supplies South of the Delta

When comparing the existing conditions, there are significant reductions in the SWP Delta exports with the SWRCB DFC that translate into a significant savings in pumping costs for the SWP. It has been suggested that an alternative comparison which recognizes that the M&I water lost with reduced Delta exports could be replaced with an equivalent amount of water produced using desalinization.

An estimate of desalinization cost (independent of conveyance) was determined to range between 3,260 and 4,900 kWh/AF (**Table 15**).

Table 15 - Power and Pumping Cost Reporting Metrics, Combined Model Results with Desal (3,260 kWh/AF)

Power and Pumping Cost Reporting Metrics

Combined Model Results With Desal (3,260 kWh/AF)					Existing	SWRCB DFC W/TRN Adj	Difference
Combined CVP and SWP Facilities							
Power Facilities							
	Energy Generation	Total of all Facilities at load center	(GWh)	Long Term	9,008	6,199	-2,808
	Generation Revenue	Total of all Facilities	($1,000)	Long Term	525,133	348,416	-176,716
Pumping Facilities							
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	8,916	3,008	-5,908
	Power Costs	Total of all Facilities	($1,000)	Long Term	463,239	155,390	-307,850
Desal							
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	0	3,514	3,514
	Power Costs	Total of all Facilities	($1,000)	Long Term	0	181,508	181,508
Total							
	Net Generation	Total of all Facilities	(GWh)	Long Term	92	-323	-415
	Net Revenue	Total of all Facilities	($1,000)	Long Term	61,894	11,519	-50,375

Notes:
1. Long Term is the average quantity for the calendar years 1922-2002.
2. 2009 Forecast (in 2007 $); Prices are forward prices as of 08/25/2009 and were developed by DWR power portfolio section.(extrapolated from a linear trend that was fitted to the estimates beginning in late 2009 and ending in 2039)

Table 16 - Power and Pumping Cost Reporting Metrics, Combined Model Results with Desal (4,900 kWh/AF)

Power and Pumping Cost Reporting Metrics

Combined Model Results With Desal (4,900 kWh/AF)					Existing	SWRCB DFC W/TRN Adj	Difference
Combined CVP and SWP Facilities							
Power Facilities							
	Energy Generation	Total of all Facilities at load center	(GWh)	Long Term	9,008	6,199	-2,808
	Generation Revenue	Total of all Facilities	($1,000)	Long Term	525,133	348,416	-176,716
Pumping Facilities							
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	8,916	3,008	-5,908
	Power Costs	Total of all Facilities	($1,000)	Long Term	463,239	155,390	-307,850
Desal							
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	0	5,282	5,282
	Power Costs	Total of all Facilities	($1,000)	Long Term	0	272,830	272,830
Total							
	Net Generation	Total of all Facilities	(GWh)	Long Term	92	-2,091	-2,183
	Net Revenue	Total of all Facilities	($1,000)	Long Term	61,894	-79,803	-141,697

Notes:
1. Long Term is the average quantity for the calendar years 1922-2002.
2. 2009 Forecast (in 2007 $); Prices are forward prices as of 08/25/2009 and were developed by DWR power portfolio section.(extrapolated from a linear trend that was fitted to the estimates beginning in late 2009 and ending in 2039)

4.7 Characteristics of San Joaquin River Tributary Hydropower Conditions with the SWRCB DFC

The SWRCB DFC affects operations on the San Joaquin River and its tributaries presented here are the effects on the Stanislaus (New Melones), Tuolumne (Don Pedro), and Merced (Exchequer) rivers. (Note that results from the Stanislaus River operations at New Melones, a CVP facility have been included in the CVP results reported in Section 4.3.)

4.7.1 New Melones (CVP)

4.7.1.1 Energy

Table 17 - Energy (GWH)

	Water Year Type					
	W	AN	BN	D	C	All Years
Existing (BO's) and SWRCB DFC Study						
Existing (BO's)	603	508	429	400	305	467
SWRCB DFC	590	462	356	297	234	412
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	-13	-47	-73	-103	-71	-55
% Change	-2%	-9%	-17%	-26%	-23%	-12%

4.7.1.2 Generation (GWH)

Table 18 - NM Generation - SWRCB DFC (Spreadsheet Model)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	15	6	3	2	24	53	83	158	131	45	43	27	590
AN	13	10	12	7	21	38	70	120	78	36	35	20	462
BN	11	6	4	5	10	30	59	97	60	27	27	18	356
D	15	9	6	6	9	26	49	68	39	26	29	16	297
C	9	8	6	5	10	23	38	47	28	21	23	17	234
All Ave	13	8	6	4	16	36	62	105	75	33	33	20	412

Table 19 - NM Generation - Existing (BO's) Study (Spreadsheet Model)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	30	12	12	22	16	58	75	91	81	80	74	52	603
AN	30	14	17	20	16	37	69	82	66	61	58	38	508
BN	30	10	7	10	10	27	65	71	54	56	54	35	429
D	28	12	8	9	10	20	56	68	50	54	52	32	400
C	17	11	7	7	10	20	37	49	40	42	40	25	305
All Ave	27	12	11	15	13	36	62	74	61	61	58	38	467

Table 20 - NM Generation - SWRCB DFC (Spreadsheet Model) minus NM Generation - Existing (BO's) Study (Spreadsheet Model)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-14	-6	-9	-20	8	-5	8	67	50	-35	-32	-25	-13
AN	-17	-3	-5	-13	5	1	1	38	13	-25	-23	-18	-47
BN	-19	-4	-3	-5	0	3	-6	26	6	-29	-27	-16	-73
D	-12	-4	-3	-3	-1	6	-7	0	-11	-29	-24	-15	-103
C	-9	-2	-1	-2	0	3	1	-2	-12	-21	-18	-8	-71
All Ave	-14	-4	-5	-10	3	1	1	31	14	-28	-25	-17	-55

4.7.2 Don Pedro

4.7.2.1 Energy

Table 21- Energy (GWH)

	Water Year Type					
	W	AN	BN	D	C	All Years
Existing (BO's) and SWRCB DFC Study						
Existing (BO's)	865	652	481	450	288	584
SWRCB DFC	672	531	382	313	198	449
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	-193	-120	-99	-137	-90	-135
% Change	-22%	-18%	-21%	-30%	-31%	-23%

4.7.2.2 Generation – GWH

Table 22 - DP Generation - SWRCB DFC (Spreadsheet Model)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	13	8	10	24	55	77	101	123	114	63	53	30	672
AN	12	5	14	16	41	52	82	115	105	37	32	19	531
BN	14	6	6	10	20	35	69	104	82	14	14	8	382
D	16	7	7	11	17	30	59	88	51	10	10	5	313
C	6	5	5	8	12	23	40	55	31	5	6	2	198
All Ave	12	6	9	15	32	48	74	100	81	30	27	15	449

Table 23 - DP Generation – Existing (BOs) Study (Spreadsheet Mode)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	25	10	21	49	80	109	105	101	124	121	74	45	865
AN	23	14	30	35	49	75	79	82	72	85	69	40	652
BN	24	8	10	14	16	44	66	70	61	73	60	34	481
D	29	10	9	14	14	37	57	64	60	70	57	30	450
C	21	8	6	11	11	22	35	39	37	44	36	18	288
All Ave	24	10	16	28	40	64	72	75	77	83	60	35	584

Table 24 - DP Generation – SWRCB DFC (Spreadsheet Model) minus DP Generation – Existing (BO's) Study (Spreadsheet Model)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-12	-2	-11	-24	-25	-32	-4	21	-10	-58	-21	-14	-193
AN	-11	-8	-16	-19	-7	-22	4	33	32	-48	-37	-21	-120
BN	-10	-2	-4	-4	3	-9	3	34	21	-58	-46	-26	-99
D	-12	-3	-2	-3	3	-7	3	24	-9	-59	-46	-25	-137
C	-15	-3	-2	-3	1	1	5	16	-6	-39	-30	-16	-90
All Ave	-12	-4	-8	-12	-8	-16	1	25	4	-53	-34	-19	-135

4.7.3 Exchequer

4.7.3.1 Energy

Table 25 Energy (GWH)

	Water Year Type					
	W	AN	BN	D	C	All Years
Existing (BO's) and SWRCB DFC Study						
Existing (BO's)	521	373	282	281	175	349
SWRCB DFC	416	331	222	158	60	258
Change from Existing (BO's)						
Existing (BO's)	0	0	0	0	0	0
SWRCB DFC	-105	-42	-60	-123	-115	-90
% Change	-20%	-11%	-21%	-44%	-66%	-26%

4.7.3.2 Generation – GWH

Table 26 - Merced Generation - SWRCB DFC

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	5	2	5	12	32	41	58	72	71	53	44	21	416
AN	7	4	8	11	23	24	48	65	61	40	30	10	331
BN	6	2	3	2	5	17	35	52	47	28	21	4	222
D	5	3	2	3	4	14	27	36	30	20	13	1	158
C	3	1	1	1	1	4	8	15	12	7	6	1	60
All Ave	5	3	4	7	16	22	38	51	47	32	25	9	258

Table 27 - Merced Generation - Existing (BO's) Study w/o VAMP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	12	8	16	29	40	39	37	73	77	75	79	35	521
AN	13	8	18	18	27	17	29	55	56	56	52	25	373
BN	12	7	6	7	7	17	30	41	49	51	40	17	282
D	14	8	7	7	8	20	33	41	46	47	35	15	281
C	10	4	4	4	4	11	21	28	30	30	23	6	175
All Ave	12	7	11	15	20	23	31	51	54	54	50	21	349

Table 28 - Merced Generation - SWRCB DFC minus Merced Generation - Existing (BO's) Study without VAMP

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-7	-6	-11	-17	-9	2	21	-1	-6	-22	-35	-13	-105
AN	-6	-3	-10	-7	-4	7	19	10	5	-16	-22	-15	-42
BN	-6	-4	-3	-5	-2	0	5	10	-1	-23	-18	-14	-60
D	-8	-5	-5	-4	-4	-6	-6	-6	-16	-27	-22	-13	-123
C	-7	-3	-3	-3	-3	-7	-13	-13	-18	-23	-17	-5	-115
All Ave	-7	-4	-7	-8	-5	0	7	0	-7	-22	-24	-12	-90